

Exhibit 4

**UNITED STATES DISTRICT COURT
DISTRICT OF NEW JERSEY**

PPG INDUSTRIES, INC.)	
)	
)	
Plaintiff-Counterclaim Defendant,)	Civil Action No.
)	2-12-CV-03526
v.)	
)	
UNITED STATES, et al.,)	
)	
Defendants-Counterclaimants.)	
)	

DECLARATION OF JOHN B. ROBERTSON

1. My name is John B. Robertson. I am over eighteen years of age and I maintain a place of business at 202 Aldersgate Court, Greenville, NC. I have personal knowledge of the facts set forth in this declaration, and am competent to testify to them if called upon to do so.

2. I have spent my entire professional career of 57 years working on environmental issues pertaining to contaminated groundwater, soil, and sediment sites, mostly involving industrial and military sites. I served 23 years as a research hydrologist with the U.S. Geological Survey (USGS) and have spent the past 34 years in the private sector as a senior consulting hydrogeologist/environmental scientist. I hold the degree of Geological Engineer from the Colorado School of Mines, plus an additional full year of graduate studies in hydrology at the University of Arizona (Master of Science equivalent).

3. My qualifications are discussed in detail in my Curriculum Vitae, which is Appendix A to my initial expert report, served October 7, 2016.

3. I was retained by the U.S. Department of Justice to review documents and prepare expert opinions pertaining to the equipment, materials, and processes used in manufacturing chemicals at the Garfield Avenue Site; waste handling and management at the Garfield Avenue Site; and PPG's conduct regarding investigation and cleanup of contamination on and near the Garfield Avenue Site.

4. Attached hereto as Attachment 1 is a true and accurate copy of my initial Expert Report, dated October 7, 2016, which contains my findings, conclusions and opinions concerning industrial processes used at the Garfield Avenue Site and cleanup cost allocation.

5. Attached hereto as Attachment 2 is a true and accurate copy of my Rebuttal Report and attachments, dated January 6, 2017, which contains my findings, conclusions and opinion in rebuttal of expert reports offered by PPG experts.


6. My expert reports provide the opinions to which I would testify in this case, along with an explanation of the bases for them and a full statement of the sources and materials upon which I relied upon in conducting my work.

6. I declare under penalty of perjury that my statements, conclusions, and opinions in my October 7, 2016 Initial Report and my January 6, 2017 Rebuttal Report, and associated table of contents, figures, and attachments in those reports, are true and correct.

7. The United States will be filing as exhibits in its Statement of Undisputed Material Facts and/or Memorandum in Support of its Motion for Summary Judgment in this case some of the documents I cited and relied upon in preparing my Reports. I have reviewed copies of the exhibits that were cited in my Reports and declare under penalty of perjury that these exhibits consist of true and correct copies of the documents, or pertinent portions of these documents, that I cited and relied upon in preparing my Reports.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.

Dated this 27 day of February 2018.



John B. Robertson

Attachment 1

**EXPERT REPORT OF JOHN B. ROBERTSON, PG
PPG INDUSTRIES, INC. v. THE UNITED STATES OF AMERICA, et al.
Civil Action 2-12-CV-03526 (JMV)(MAH) US District Court, District of New Jersey**

**Prepared for the United States Department of Justice, Environment and Natural Resources
Division**

Prepared by John B. Robertson, PG, Consulting Hydrogeologist and Environmental Scientist

October 2016

Signature: John B. Robertson **Date:** 10/07/16

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1.0 INTRODUCTION

1.1 Background and Summary of Case Issues

I am serving as an industrial process and cleanup cost allocation expert witness for the United States Department of Justice, Environment and Natural Resources Division (DOJ/ENRD) in the above-captioned litigation case. Lewis M. Barr is the lead DOJ attorney. This report constitutes my expert report and presents my technical opinions and bases thereof in response to my assignment from the DOJ.

PPG Industries, Inc. (PPGI), is currently being held responsible for most of the investigation and cleanup activities and costs associated with contamination from its former chromate chemical manufacturing plant located on Garfield Avenue in Jersey City, New Jersey (Plant). Contamination at the Plant site and at other sites in Hudson County is the subject of PPGI's complaint against the United States.¹ The primary contaminant of concern (COC) is hexavalent chromium (Cr-6). Trivalent chromium (Cr-3), other toxic metals and a few organic chemicals are minor COCs. In this report, I use the term PPGI to include all past owners and operators of the Plant that were connected to PPGI.

The case involves soil, fill, and groundwater contamination by wastes generated at the Plant which was used to process chromite ore into sodium chromate and sodium bichromate chemicals. The Plant operated for a period of approximately 54 years – from 1909 through 1963. The Plant was operated by Natural Products Refining Company (NPRC) until 1954, when a subsidiary of Pittsburgh Plate Glass Company (PPG), Columbia Southern Chemical Co., purchased the facility. PPGI, the successor to PPG, was the final owner and operator of the Plant before it ceased operations in 1963.

The chromate production process employed at the plant generated relatively large volumes of solid waste residues that contained trivalent and hexavalent chromium. These wastes are commonly referred to as “chromate compound processing waste” (CCPW) and “chromite ore processing residue” (COPR). Green-gray mud is also a term used for the most abundant component of CCPW. I generally use the term CCPW to refer to any of the solid wastes associated the Plant processes.

In this report, I use the term “Government” to include any agency of the United States federal government.

¹ PPG Industries v. United States, First Amended Complaint, October 31, 2012.

Plaintiff, PPGI, claims that agencies of the Government bear liability for the environmental harm associated with wastes produced at the Plant and should be held responsible for the investigation and cleanup costs associated with that harm. The DOJ, on behalf of the Government, disputes Plaintiff's claim, and has asserted a counterclaim.

The environmental contamination at issue involves multiple properties within Hudson County, New Jersey. The primary property is the original PPGI Plant site on Garfield Avenue, together with an adjacent parcel on which PPGI stockpiled solid wastes. Additional contaminated properties are those at which PPGI chromium wastes were disposed by third parties that hauled PPGI wastes from the Plant and adjacent sites to off-site construction sites as fill material.

The New Jersey Department of Environmental Quality (NJDEP) determined that the chromate wastes from PPGI's Plant posed significant risks to public health and the environment in the mid-1980s, and initiated a series of regulatory enforcement actions directed at PPGI and two other chromate chemical manufacturing firms. PPGI has responded with a long series of investigations and remedial actions over the past 30 years, or so. As of the date of this report, remedial actions in response to the contamination from PPGI's waste have not been completed.

1.2 Areas of Expertise and Summary of Qualifications

The areas of expertise that I bring to this assignment include the following:

- Environmental science
- Geology, hydrogeology, and hydrology
- Behavior and fate of contaminants in the environment, especially in soil and groundwater
- Methods and approaches for allocating or apportioning costs among potentially responsible parties at contamination sites
- Historical commercial and military industrial processes and associated waste streams
- Industrial waste management
- Interpretation of environmental data, maps and aerial photographs
- Roles and activities of government officials in private sector wartime industrial production

I have spent my entire professional career of 55 years working on environmental issues pertaining to contaminated groundwater, soil, and sediment sites, mostly involving industrial and military sites. I served 23 years as a research hydrologist with the U.S. Geological Survey (USGS) and have spent the past 32 years in the private sector as a senior consulting hydrogeologist/environmental scientist. Most of my career work has been devoted to investigating the behavior and fate of a wide spectrum of contaminants (organic and inorganic) in soil, groundwater, and sediment systems. My research with the USGS included many years of work on the behavior and fate of heavy metals, radionuclides, chlorinated organic compounds, pesticides, and petroleum hydrocarbons in soil and groundwater.

Among the sites that I have worked on are many WWI- and WWII-vintage military and industrial sites with heavy metals (including chromium) and chlorinated organic compounds contamination, such as former Teledyne Ryan aircraft plant, San Diego, CA; Norfolk Naval Shipyard, VA; Miami International Airport, FL; Lockheed Burbank Plant, CA; Basic Magnesium Plant, Henderson, NV; former Harrington Army Airfield/Beech Aircraft Site, KS; former Republic Aircraft plant, Long Island, NY; former

Grumman Aircraft Plant, Long Island, NY; Coffeyville Army Airfield, KS; Fort Riley, KS; Schilling Air Force Base, KS; Camp Crowder, MO; Moses Lake Army Airfield, OR; and Schofield Barracks area, HI.

My experience includes work on a number of sites and projects in New Jersey, including the former Ultramar petroleum terminal in Hudson County, and I am familiar with general hydrogeological conditions in New Jersey.

My industrial processes experience has involved matters relating to the manufacture of many diverse productions and materials, as well as many and diverse hazardous substances, as that term is used in environmental laws. For example, my experience has included:

- wood treatment sites contaminated with chromium, other metals, and organic compounds
- former manufactured gas production sites
- ore processing and metal production facilities for iron, steel, aluminum, magnesium, titanium, uranium, vanadium, copper, lead, zinc, silver, and gold
- industrial processes that use chromate chemicals
- hazardous waste incineration facilities using large rotary kilns

I hold the degree of Geological Engineer from the Colorado School of Mines, plus an additional full year of graduate studies in hydrology at the University of Arizona (Master of Science equivalent).

My service as an expert witness includes more than 30 environmental litigation cases with testimony in 14 major trials. My professional publications include more than 40 papers in professional journals or books and one text book on soil and groundwater contamination problems and remedial approaches.

I have served as chairman of several national professional organization committees on groundwater hydrology and have been appointed to several national and international technical advisory groups on environmental issues. Details of my relevant training, experience, and qualifications are provided in the attached curriculum vitae (Appendix A).

1.3 Assignment from the Department of Justice

The DOJ has asked me to perform independent review and analysis of relevant evidence and to formulate scientifically supportable technical opinions relating to the following issues within my areas of expertise:

- 1. What equipment was used and what processes were employed at the Jersey City site operated first by Natural Products Refining Company and then by Columbia-Southern Chemical Company, a subsidiary of Pittsburgh Plate Glass Co. from 1909 through 1964?**
- 2. How and by whom were wastes from the chemical manufacturing processes at this Jersey City plant handled and managed?**
- 3. What factors relating to the manufacturing and waste management operations at the Jersey City plant should be considered by the Court in the event that any equitable allocation of responsibility for cleanup costs is warranted in this litigation?**
- 4. What factors relating to PPG's conduct regarding investigation and cleanup of contamination on and near the Jersey City site from the early 1980s and to the present should be considered by the Court in the event that any equitable allocation of responsibility for cleanup costs is warranted in this litigation?**

1.4 Testimony in Previous Cases

I have previously provided expert deposition testimony in more than 30 environmental litigation cases including 14 involving trial testimony. In the past four years, I have provided testimony in the following cases:

1. TRAVELERS INDEMNITY COMPANY, et al., v. NORTHROP GRUMMAN CORPORATION, et al., CIVIL ACTION NO. 12-cv-03040-(KBF) (FM), UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF NEW YORK; deposition, 2013; for White & Williams law firm, Philadelphia, PA.
2. TDY HOLDINGS, LLC, AND TDY INDUSTRIES, INC., v. UNITED STATES, et al., CASE NO. 07-CV-0787-JAH (P0R), UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF CALIFORNIA; deposition and trial, 2012; for U.S. Department of Justice

1.5 Compensation

The DOJ compensates me for the time I spend on this case at the rate of \$175.00 per hour, plus reimbursement for necessary expenses.

2.0 TECHNICAL APPROACH

To carry out my assignment, I have employed standard technical approaches typically used by technical professionals in my fields of expertise. These include, but are not limited to, review of relevant documents produced through discovery by the parties in this case, review of relevant technical references available in libraries and online, review and analysis of historical aerial and land-based photographs, analysis of chemical and environmental data provided in numerous site investigation reports, and reliance on my experience at other sites with similar environmental issues.

3.0 DOCUMENTS RELIED ON

I have examined thousands of documents relating to this case, most of which are contained in a computer data base established and maintained by DOJ. In addition, I have consulted relevant text books, technical publications in libraries and online sources. Documents I have relied on are cited directly in the text of this report and as footnotes. I am also relying upon the expert reports submitted on behalf of the United States in this matter by Dr. Jay Brigham, Dr. Jan Kool, Dr. Joan Meyer, and Ms. Kristen Stout, the documents cited in their reports, and intend to rely on their testimony in depositions and at any trial in this matter.

4.0 OPINIONS

These opinions are based on the current status of my review of documents related to the case, which is continuing. The information contained in the sources that I have reviewed thus far is sufficient to support

each opinion with a reasonable degree of scientific certainty. These opinions bear both on liability issues, and to the extent that the court finds Government liability, on the court's equitable allocation analysis. I reserve the right to revise any of these opinions, if I become aware of new information that might warrant such revision.

The opinions below relate not only to the liability allegations in this case, but also the equitable factors to be considered by the Court in the event an equitable allocation becomes necessary.

4.1 Opinions related to the equipment and materials used and processes employed in manufacturing chemicals at the Jersey City site

1. The Plant operated as a private chromate and bichromate chemical production facility from approximately 1909 through 1963.

Basis of Opinion

See the Expert Reports of Dr. Jay L. Brigham (Section II) and Kristen K. Stout (Sections 5.1 and 7.3) See also, PPGNPR0089439-449; Jersey City Development Authority v. PPG Industries, Inc., answers to Defendant's interrogatories numbers 20 and 24, 08/05/1986 ; 1911 Sanborn Insurance map [PPGNPR00193937].

2. The primary product manufactured at the Plant was sodium bichromate ($\text{Na}_2\text{Cr}_2\text{O}_7$). Secondary products were sodium chromate (Na_2CrO_4), potassium bichromate ($\text{K}_2\text{Cr}_2\text{O}_7$), chromic acid, vanadium and aluminum byproduct compounds, and sodium sulfate. Generally, one net ton of 44 percent chrome chemical ore was required for the production of 1400 lbs. sodium bichromate. Before, during and after World War II, these primary chromium chemicals were almost entirely sold to "process" industries, which used them as raw materials in making other chemicals or other kinds of products..²

Basis of Opinion

See for example, PPGNPR0610957; PPGNPR0611607-56 at 12-16.

3. The processes, raw materials and equipment used by NPRC and PPGI to manufacture chromate, bichromate and related products at the Plant are described in numerous documents produced by PPGI in this case and testimony in other lawsuits against PPGI,³ and can be summarized as follows:

² A 1949 Government report on chemical chromite stating that the primary chemical made from chemical grade chromite ore is sodium bichromate. "From this all other chrome chemicals such as chromic acid, chrome pigments, tanning compounds, etc. are made." It noted that one thousand pounds of sodium bichromate required "66975 long tons of chemical grade chromite ore (44% Cr_2O_3 app.)" USNPR009064-65

³ See e.g., PPGNPR0010907-31, PPGNPR0027995-8022; USNPR0009094-98; USNPR0013837; PPGNPR0180217-18; PPGNPR0063755; PPGNPR0610957; PPGNPR0610958; PPGNPR0610959; PPGNPR0611607-56 at 11; PPGNPR0000206-09; PPGNPR0558314-18 at 15; PPGNPR0835881-82; PPGNPR0033416-20 at 18-19; PPGNPR0033296-301 at 298; PPGNPR0181868; PPGNPR0557613-736 at 618-23, 642; PPGNPR0070184-340 at 297-301, 304; PPGNPR0027520-701 at 601-635, 640, 642-44, 652-53, 680; PPGNPR0065452-563 at 487-89, 492-94; 510-15, 519; PPGNPR0136022-93 at 83-85.

Raw Materials

The basic raw material used in the production of chromium chemicals is chromite ore. [See, e.g., PPGNPR0611607 at 611]. “Transvaal grade B” chromite ore was used in Natural Products Refining Company’s manufacturing process during and after World War II. [See, e.g., USNPR0003976; PPGNPR0610932 at 947-49; PPGNPR0010907 at 912; PPGNPR0027995 at 997; PPGNPR0558309 at 15 (“[T]he chromium chemical industry in the United States is now built around the use of Transvaal ‘Grade B Friable’ chemical ore . . .”); PPGNPR0558868]. This type of chromite ore contain less than 45% Cr₂O₃. [See, e.g., PPGNPR0010907 at 912; PPGNPR0610932 at 947-49]. During the period of PPG’s operation of the Plant, all of the chromite for all of the producers of chromium chemicals in the United States was Transvaal ore. [See, e.g., PPGNPR0557613 at 618].

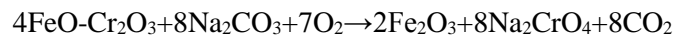
Facilities and Equipment

PPG’s July 15, 1954 application for listing on the New York Stock Exchange described the facilities as Natural Products Refining Company as follows: “*Natural Products Refining Company started business with hand-operated coal-fired refractory furnaces in 1909. In 1931 and 1932 it built its first three oil-fired automatic revolving kilns. In 1934 it erected Building No. 20, an aluminum treatment building. In 1936 the Company built a new filter building. Building No. 20-A was erected in 1938 to house miscellaneous manufacturing processes. Two new Babcock and Wilcox automatic oil-fired boilers were installed in 1937 and in 1940. A new office building was built in 1949. A new kiln, the fourth, was constructed this year.*” [PPGNPR0089439 at 47]. A June 22, 1984 report prepared for PPG included a diagram of the Plant as it existed from 1957 – 1963. [PPGNPR0557642; see also PPGNPR0180217-18; USNPR0009094-98; USNPR0013837; PPGNPR0063755 (drawings and maps)].

See Expert Report of Kristin Stout (Sections 7.3 and 7.18 and Figures 7-12 and 7.22).

Chrome Roasting

An alkali fusion process was used to convert an insoluble form of chromium in the chromite ore – the mineral spinel, FeO-Cr₂O₃ (Cr-3 valence state) -- to soluble sodium chromate (Cr-6 valence state). The ore was crushed and ground to a fine particulate form and mixed with soda ash (sodium carbonate, Na₂CO₃) and recycled waste from previous roasting and leaching batches to dilute the raw feed stock. Diluting the feed stock was done to modify physical properties for roasting and keep the melted chromate from flowing and coating unreacted ore. [See, e.g., PPGNPR0557613 at 619. The diluent used was dried and ground chromium waste mud. See, e.g., PPGNPR0557613 at 619; PPGNPR0027520 at 601-603]. The feed stock was then fed to a large direct-fired rotary kiln and roasted at a temperature of about 1000° C in the presence of oxygen (air) to oxidize the Cr-3 to Cr-6. The chemical reaction for this conversion is:



The roast was cooled on exiting the kiln before being leached with water. In addition to using sodium carbonate, some roasting during the period of 1957 through 1963 was also carried out

using lime (calcium oxide) as a source of alkali and diluent, to improve roasting results. [PPGNPR0557613 at 619; PPGNPR0027520 at 601-603. See also PPGNPR0611607 at 612-16; PPGNPR0033416 at 418-19; PPGNPR0033296 at 298].

Leaching

The leaching step was carried out in leach beds where the roast was given a four-stage, counter-current leach with progressively weaker chromate/water solutions. [PPGNPR0181868; see e.g., PPGNPR0033416 at 418-19; PPGNPR0557613 at 620-21; PPGNPR0027520 at 616-19]. Following the final leach, some of the residual mud was discarded, some was made available for sale, and some of the waste mud was recycled to the roast step. [See, e.g., PPGNPR0136022 at 6083; USNPR0007921 at 7948; PPGNPR0027520 at 620; PPGNPR0065452 at 487-89; PPGNPR0033296 at 298].

Purification

The sodium chromate solution from the leaching step was purified by precipitating less soluble aluminum and vanadium compounds, which were sold as by-products. [See, e.g., PPGNPR0611607 at 611; PPGNPR0033416 at 418-19; PPGNPR0065452 at 487-89; PPGNPR0181868]. After purification, the sodium chromate solution was ready for manufacture of finished product. [PPGNPR0557613 at 622-23].

Sodium Dichromate Manufacture

Sodium dichromate was manufactured by reacting the sodium chromate with sulfuric acid. Sodium sulfate was formed as a byproduct and sold. [See, e.g., PPGNPR0033296 at 298; PPGNPR0181868; PPGNPR0017185 at 210; USNPR0007921 at 7948].

Products

Sodium chromate and sodium dichromate solutions (yellow liquors) were evaporated, allowing crystallization of those compounds, which were then dried, packaged and sold. [See, e.g., PPGNPR0033416 at 418-19; PPGNPR0181868; PPGNPR0557613 at 622-23].

A basic flow diagram of this process is shown in Figure 1.

Basis of Opinion

See documents and testimony cited above regarding the processes. The facilities are described in the Expert Report of Kristin K. Stout.

4.2 Opinions related to how and by whom wastes from the chemical manufacturing processes at the Jersey City plant were handled and managed

1. The chromate chemical manufacturing process employed by NPRC/PPGI was a relatively crude and messy operation that generated large quantities of solid wastes containing chromium compounds. Waste streams generated at the Plant included the following:
 - Residual mud after the leaching step, sometimes called “green-gray mud”, which was the largest waste product (contained residual Cr-3 and Cr-6).
 - Caustic filter sludge from the sodium chromate solution purification step
 - Waste water from the sodium bichromate solution evaporation unit (contained Cr-6)
 - Waste water from the sodium chromate solution evaporation unit (contained Cr-6)
 - Airborne dust from: crushing, grinding and roasting chromite ore (contained Cr-3 and other metals) and from packaging final chromate products (contained Cr-6)

Basis of Opinion

According to the United States EPA, residual mud residue from the leaching and neutralization step for the general chromite ore process employed by plants like PPGI’s typically contained 15-20 percent Cr-3 as Cr_2O_3 , 0.3-1 percent Cr-6 as sodium dichromate, 30 percent water and 70 percent solids.⁴ An internal PPGI memorandum (06/22/1984) states that, on average, PPGI CCPW mud contained 11.1 percent Cr-3 as Cr_2O_3 and 1.4 percent Cr-6 as sodium bichromate.⁵

The same PPGI document claims that PPGI generated about 76,440 tons of waste chromite ore processing mud from 1954 through 1963, that 62,000 tons was stored on-site in 1954 and that the author believed [incorrectly] that no mud was stored on the site in 1964. As pointed out later in this report, site environmental investigations proved that considerable quantities of chromium-laden waste mud remained on site after 1964 as fill. The 1984 PPGI document also states that 138,000 tons of mud were produced from 1957 through 1963 and that two large waste piles were at the Plant site when PPG took over in 1954 (about 14,600 tons in the back and about 47,000 tons on a parcel south of Carteret Avenue).

The NJDEP stated that chromate plants in the Jersey City area generated a total of 969,500 tons of chromite ore processing waste.⁶ NJDEP claimed in the same document that about one-third of the chromium in the waste was Cr-6. PPGI admitted that the Plant generated approximately 330,000 tons of CCPW during its lifetime (see basis for Opinion 4.2-4, below).

2. Waste management practices employed by NPRC and PPGI included the following:

Most of the solid chromate compound processing waste (CCPW, also referred to as chromite ore processing residue, or COPR), which included green-gray mud, other residuals from the leached crushed ore, and filter sludges, was stockpiled on bare ground on Plant property. This waste generally contained 15 to 20 percent Cr-3 compounds and 0.3 to 1 percent Cr-6 compounds. The stockpiles were left uncovered and exposed to the elements. Residual Cr-3 and Cr-6 was thereby

⁴ www.epa.gov/osw/hazard/wastetypes/wasteid

⁵ PPGI Memorandum from Chester Milczarek to Susan Kuis, 06/22/1984 [PPGNPR0557613-641]

⁶ NJDEP Directive and Notice to Insurers in the Matter of the Hudson County Chemical Production Waste Sites Case, Allied Signal, Inc., Occidental Chemical Corp. and PPG Industries, Inc., Respondents, 01/08/1998, 25 pp. [PPGNPR0032410-434]

allowed to leach from those wastes into the underlying soil and groundwater. Most of those wastes were eventually sold or donated for use as construction site fill material at off-site locations.

Crushing, grinding and roasting of the chromite ore generated large quantities of airborne dust throughout much of the Plant area. Processing and packaging of the final chromate products also generated significant quantities of airborne dust. Some of the particulate dust was discharged to the atmosphere through exhaust stacks for the roasting kilns.

Liquid wastes were apparently discharged to storm sewers at the Plant at times via surface ditches. See Expert Report of Kristin K. Stout.

Basis of Opinion

The basis for this opinion is contained in the basis for Opinions 4.2-3 and -4, below.

3. Much of the COPR/CCPW that was stockpiled on-Site by NPRC/CSCC/PPGI was sold or given to third parties who removed the waste and used it as land fill for construction at many different sites throughout Hudson County.

Basis of Opinion

Many documents produced for this case describe this process used by PPGI for disposing of its on-Site chromium-bearing waste. For example, the NJDEP Administrative Consent Order of 07/19/1990 states in its findings that chromite ore processing residue was distributed by third-parties from PPGI's operations as fill material for various applications.

A 1984 internal PPGI memorandum states that the waste mud stored on-site was mostly sold at 10 cents to 50 cents per yard and that some was given away.⁷ The same document indicates that 59,000 cubic yards of the CCPW mud was stockpiled on the ground at the Site when PPGI took over in 1954. The memorandum also indicates that an additional 148,000 cubic yards of mud were generated by PPGI from 1954 to 1963.

A series of PPGI invoices indicate that PPGI sold about 8000 cubic yards of its CCPW waste to Lawrence Construction Co. in 1962 alone [PPGNPR063664-678]. Another PPGI invoice indicates that 4800 cubic yards were sold to Lawrence Construction in April 1959 [PPGNPR063662].

4. By one account, the former PPGI Plant generated approximately 330,000 tons or more of chromate chemical production waste (CCPW) over its operational history, although it is not clear from the documents the length of the period assumed for that account. [USNPR0007921-8854 at 7948]. NPRC or PPGI recirculated a minority portion of those residues in their manufacturing processes.

Basis of Opinion

⁷ PPGI Memorandum from Chester Milczarek to Susan Kuis, 06/22/1984 [PPGNPR0557613-641]

A 1998 Directive from NJDEP to PPGI⁸ concludes that 969,500 tons of chrome wastes were produced by the three named respondents. PPGI reportedly generated 330,000 tons of that total. According to the Directive, PPGI admitted to generating 330,000 tons of CCPW.

5. The predominant chemical forms of chromium in the Plant wastes are trivalent (Cr-3) and hexavalent (Cr-6). Each of the three categories of Plant chromium wastes contain both chemical forms of chromium. Both forms of chromium are toxic to humans and some biota in the environment, but Cr-6 has a much greater toxicity to humans than Cr-3. Cr-6 poses serious health risks to humans through dermal, eye, nasal passage, and pulmonary contact and is a carcinogen to humans through inhalation exposure.

Basis of Opinion

Human toxicity of both common forms of chromium (Cr-3 and Cr-6) has been known for many decades and well documented in the technical and regulatory literature.⁹ The studies cited in the basis for Opinion 4.4-10, below, provide more details on the history of our awareness of this fact. Those studies also clearly establish that Cr-6 is much more toxic to humans than Cr-3.

An internal PPGI memorandum in 1984 stated that the average plant mud contained 11.1 percent Cr-3 (as Cr₂O₃) and 1.4 percent Cr-6 as sodium bichromate.¹⁰ The same PPGI memorandum also states that a 1957 study showed that 15,800 lbs per day of dust (containing chromium) were emitted to the atmosphere by the Plant and that, *"This represents a neighborhood nuisance and has been the source of public complaints."*

An internal CSCC study of chromium-laden dust problems in 1957 stated, *"...it can be concluded that the soda building, hydrate building, kiln building, leach building and mill building are unsafe areas [based on excessive Cr-6 levels in the air]."*¹¹

Another internal CSCC memorandum states, *"At present, we [PPG] are polluting the atmosphere by discharges of approximately 15,820 pounds per 24 hours by solid entrainment in the mud dryer and kiln exit gases. This represents a neighborhood nuisance and has been the source of public complaints."*¹²

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

6. At least some portions of the three most significant types of chromium waste residues at the Plant each contained sufficient quantities of Cr-6 to pose risks to human health and the environment if managed in an unprotected manner.

⁸ Directive and Notice to Insurers in the Matter of the Hudson County Chemical Production Waste Sites and Allied Signal, Inc., Occidental Chemical Corp., and Pittsburgh Plate Glass Industries, Inc., Respondents, by NJDEP, 25 pp., 01/08/1998 [PPGNPR0032410-434].

⁹ See for example, www.stsdr.cdc.gov (Chromium (Cr) Toxicity)

¹⁰ PPGI Memorandum from Chester Milczarek to Susan Kuis, 06/22/1984 [PPGNPR0557613-641]

¹¹ Report I Airborne Hexavalent Chrome Jersey City Plant, by J.U.S. Gouin, 01/10/1957 [PPGNPR064461-62]

¹² PPG Memorandum from D.B. Dailey to D.R. Dunham, 05/03/1957, regarding Air Pollution Abatement [PPGNPR075601-602]

Basis of Opinion

The three most significant chromium-bearing solid wastes were the mud from the leaching step, filter cake from leachate filtering and airborne dusts from various processes in the Plant. The mud residue was the most voluminous of these wastes.

NJDEP determined in 1990 (07/19/1990) Administrative Consent Order [PPGNPR0029975-30347] that the chromium and chromium compounds in PPGI's chromium processing residue create a substantial risk of imminent danger to human health and the environment. Human health risks from exposure to chromium chemicals, especially those containing Cr-6, had been widely known in medical and industrial circles since at least the early 1940s.¹³

PPGI also had extensive data on the presence and distribution of Cr-6 laden dust in many of the Plant operations areas in the mid- to late 1950s. For example, an internal report by John LaPallo (04/30/1958) reports that the inside of the Operations Building was coated with Cr-6 dust and that much Cr-6 dust was being circulated in air during full operation (presenting a health hazard to workers) [PPGNPR0032604-608]. In another internal report by Mr. LaPallo (07/03/1958) concluded that Cr-6 dust had worsened in some areas and there was much evidence of sloppy, unsafe conditions and practices [PPGNPRO032609-612]. He states further that, *"It is quite evident from the data presented that most operating stations discharge a large amount of hexavalent chromium dust."* He concludes that carelessness of workers is a factor and that PPGI is not making an effort to improve conditions.

The masses of CCPW mud wastes that were stockpiled on the PPGI were known to contain leachable Cr-6. An internal CSCC memorandum dated 04/04/1957 from C.J. Milczarek (Jersey City) to a company official in Corpus Christy, Texas, states, *"We checked some of our water draining off our mud pile during our last rain. We obtained a chromium concentration of nearly 1 gpl as Na₂Cr₂O₇·2H₂O [Cr-6]. Of course we don't know how representative this figure is since we were not able to determine the history of the mud pile."* [PPGNPR0064426]

PPGI also sampled rainfall runoff water and associated soil (waste) samples in the southwest part of the Plant property (area used for CCPW stock piling) in July, 1982 [PPGNPR0089427-430]. The analytical results showed that the three water samples had Cr-6 concentrations of 7 to 100 ppm as sodium chromate. The three soil/waste samples contained total chromium concentrations ranging from 11.8 percent to 19.7 percent, as sodium chromate.

See also PPGNPR0067542-683 at 648-49, 680-81 (3/27/87 deposition of Chester J. Milczarek).

4.3 Opinions related to the extent of involvement of United States Government agencies in the industrial activities and waste management at the former Plant, especially during war time:

1. Government personnel did not operate, control or direct any facilities or operations at the Plant, including manufacturing operations or the management and disposal of wastes.

¹³ See the more detailed support for this conclusion presented in the basis for Opinion 4.4-10 below.

Basis of Opinion

See Export Report of Dr. Jay L. Brigham (Sections V and VI).

PPGI claims that the Government required NPRC to increase quantities of hazardous waste generated at the Site. Several documents are cited by PPGI to support this claim in its response to the United States' First Interrogatory No. 25². I have reviewed those documents and found nothing in them to support PPGI's claim. They are Government documents describing aspects of the shortage of chromate chemicals and steps the Government was taking to help address the shortage. None of those documents state that the Government required NPRC to do anything to increase production or to generate more hazardous waste. At most, some of the documents indicate that the Government encouraged NPRC to take certain suggested steps voluntarily.

In PPGI's response to Interrogatory No. 1 of the United States' Second Set of Interrogatories it cited several documents that it claimed support PPGI's contention that the Government exercised direction or control over NPRC's transport, management, storage, handling, distribution, disposal, release, sale, or gift of wastes at or from the Site. None of the documents cited by PPGI support its claim.

2. None of the property, buildings, equipment or other facilities associated with the Plant was ever owned or operated by any agency of the federal government. NPRC declined to enter into a lease agreement with the federal Defense Plant Corporation during World War II (WWII). NPRC did not accept any offer by any federal agency to finance the costs of increasing production capacity at the Plant, nor did NPRC receive any federal funds for that purpose. The Government did not own any of the manufacturing or waste disposal machinery or equipment used at the Plant at any other time. The Government did not order, oversee, or direct the construction of any facilities at the plant.

Basis of Opinion

Ownership of "facilities" that were involved with the release of hazardous substances at a CERCLA site, such as the PPGI Site in Jersey City, is one criterion that can cause a party to bear liability for contamination at such a site. The available evidence indicates that the Government never owned any of the equipment, buildings, land, or other facilities at the Site involved with chromium chemical production during the Plant's operational period. Therefore, the Government should bear no cleanup responsibility based on this criterion.

PPGI does not claim in its complaint for this case that the Government had any such ownership liability. In fact, PPGI states in its response to the Government's First Interrogatory No. 21 that PPGI does not contend that the United States owned any buildings, machinery, equipment, etc., at the Site.¹⁴

¹⁴ PPGI Amended Supplementary Objections and Responses to the United States' First Set of Interrogatories, May 22, 2014.

A document cited by PPGI in its responses to Government interrogatories² [PPGNPR0000555-557], clearly indicates that NPRC rejected an offer by the United States' Defense Plant Corporation to finance a plant expansion to increase production. See also PPGNPR0015736-741.

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

3. Government agencies or personnel did not own, or take control or possession of any waste products generated by chromate production activities at the Plant. I have reviewed no evidence indicating that NPRC or PPGI ever expressed an understanding that some of those wastes were owned by the Government or that the Government should remove them from Plant property.

Basis of Opinion

PPGI claims that the Government owned some of NPRC's chromate processing wastes, such as sludge from a once-through processing of high grade ore. I have reviewed the documents cited by PPGI in support of this contention in its response to the Government's First Interrogatory No. 24. None of those documents provide evidence that support PPGI's position. None of the documents cited by PPGI indicate that NPRC actually did process any high grade ore or that the Government ever took title to any of NPRC's sludge or other waste from that processing or any other processing.

Although one agency of the Government proposed in 1944 that another agency purchase certain volumes of NPRC's chromium-bearing wastes, the proposal was rejected by the agency that would have implemented it, the plan was never implemented, and no such federal purchases ever occurred.

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

4. The Government did not transport or arrange for the transport of any Plant wastes to other locations.

Basis of Opinion

None of the evidence cited by PPGI in its responses to the United States' Interrogatories indicates that the Government ever transported any PPGI wastes to or from the Plant site or any other sites at issue in this case. Neither could I find any evidence of such transport by the Government.

5. The Government did not issue any approval or disapproval of any of NPRC's or CSCC's waste management or disposal practices, nor did the Government have authority to do so.

Basis of Opinion

By evidence presented in other Opinions stated in this section, it is clear that the Government never had personnel stationed at the Plant and was never involved in directing any of the processes at the Plant, including waste management. None of the evidence cited by PPGI in its responses to the United States' Interrogatories indicated that the Government approved or disapproved of NPRC/CSCC waste management.

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

6. The Government did not issue any approval or disapproval any of NPRC's or CSCC's plant worker safety or industrial hygiene practices, nor did the Government have authority to do so.

Basis of Opinion

By evidence presented in other Opinions stated in this section, it is clear that the Government never directed or controlled any of the processes or affairs at the Plant, including worker health and safety.

7. NPRC did not participate in a 1944 Government subsidy program offered to chromate chemical producers as an incentive for increasing chromate production with metallurgical grade chromite instead of the standard and lower cost chemical grade chromite.

Basis of Opinion

Although NPRC initially signed an agreement on 06/02/1944 to participate in a Government subsidy program intended reimburse chromate companies for increased costs of processing high-grade chromite ore, NPRC never filed a claim pursuant to that program [PPGNPR0010820-829, PPGNPR0010838, PPGNPR0010899].

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI) .

8. The Government never compelled, ordered, or coerced NPRC or CSCC to increase the Plant's production of chromate chemicals or to expand or build new facilities, nor did it seize or threaten to seize NPRC's plant.. The Government never forced or coerced NPRC or CSCC to manufacture any chromium chemicals. Neither NPRC nor CSCC ever manufactured chromium chemicals involuntarily. The Government did not order, force or coerce NPRC or CSCC to change the manufacturing processes employed at the plant or to use different chromite ore types, such as higher-grade, more expensive ores.

Basis of Opinion

PPGI claims in its complaint for this case the agencies of the Government mandated, directed, required or ordered NPRC to expand facilities or construct new facilities. I have reviewed all the documents that PPGI cited as support for this position in its response to the Government's Interrogatory No. 22. None of those documents support PPGI's claim, nor does any other evidence that I have reviewed. Likewise, I have seen no evidence to support PPG's allegations of other forms of Government coercion.

In its response to the Government's Second Set of Interrogatories No. 11, PPGI contends that the Government coerced private industry (chromate manufacturers) by threatening seizures and military take-over if contractors refused to accept price controls. The document cited by PPGI [PPGNPR0013396-416] provides no such evidence that the Government ever threatened to seize or take control of NPRC's Plant.

See also Expert Report of Dr. Jay L. Brigham Sections V and VI).

9. The Government never employed or supervised workers at the Plant.

Basis of Opinion

PPGI's response to the Government's Second Set of Interrogatories No. 12 claims that the Government placed workers that were ineligible for the military draft in the NPRC plant. None of the documents cited by PPGI support this claim. Although the Government internally discussed the idea of having workers of Japanese descent, prisoners, Jamaicans, and others work in the chromate plants to help manpower shortages during WWII, I found no evidence that the Government went beyond such discussions or that the idea was ever implemented at the NPRC plant. Neither did I find any other evidence that the Government supplied such workers to NPRC's Plant or directed, forced, or coerced NPRC to hire any workers identified to the company by the Government.

The Government made suggestions in 1944 to assist NPRC with its labor shortages.¹⁵ However, I found no evidence indicating that the Government issued any orders or directives to NPRC regarding hiring or for using Government-identified hires.

Proceedings from a 1945 meeting of the Government's Chemical Task Group [PPGNPR0028119-159] indicate that the Government offered to help the chromate production plants with their labor shortages by supplying foreign workers from Jamaica and Mexico, but the plants chose not to accept the offer, citing potential union problems and questionable community acceptance. This is another indicator that the plants were fully free to manage their employment issues and that the Government did not exercise any control over plant labor.

10. Although the Government made certain recommendations to NPRC during World War II for improving working conditions in order to attract new employees and reduce worker turn-over, NPRC was free to accept or reject any such recommendations. I found no evidence that any Government recommendations or suggestions were implemented by NPRC.

Basis of Opinion

During WWII, the Government was concerned about maintaining an adequate supply chain of chromate chemicals from private industry to meet war material production needs. At times, the chromate manufacturers had trouble keeping production at maximum capacity and meeting industrial demands, due to labor shortages or other issues. Government officials offered some suggestions and financial incentives to help alleviate production problems, but never forced NPRC or other chromate manufacturers to change their production processes. None of the evidence cited by PPGI or that I have reviewed indicates otherwise.

¹⁵ Memorandum from Headquarters Army Service Forces to Production Division ASF, 04/18/1944 [PPGNPR0027778-80]

11. The Government had no involvement in NPRC or CSCC decisions and actions that caused the distribution of the Plant's chromium-bearing wastes to be used as fill at many construction sites in Hudson County, NJ.

Basis of Opinion

None of the evidence that PPGI cited in its responses to the United States' Interrogatories for this case indicate any involvement of the Government in NPRC/CSCC's decisions and actions that resulted in PPGI selling its stockpiled CCPW for offsite transport and use as construction fill material at construction sites throughout Hudson County. Neither have I been able to find any such evidence.

See also Expert Report of Dr. Jay L. Brigham (Section V).

12. During the period of 1943-1946, the Government (through the Metals Reserve Corporation) sold chromium ore to NPRC; no evidence has been found to indicate that anyone but NPRC had any ownership in the ore once it was delivered to the Plant's rail siding.

Basis of Opinion

Many documents support NPRC's purchase of Government-owned ore [See, e.g., PPGNPR0015869-870, PPGNPR0015847, PPGNPR0015872, PPGNPR0015862, and PPGNPR0015850]. All the relevant documents that I have reviewed clearly indicate that NPRC purchased its ore from the Government and took title to and control of it, when it was delivered to NPRC's Jersey City Plant.

See Expert Report of Dr. Jay L. Brigham (Sections V and VI).

4.4 Opinions related to NPRC/CCSC's waste management practices and awareness and conduct regarding risks posed by Plant wastes to workers, the community and the environment, as might relate to equitable factors for the Court to consider in an allocation.

1. PPGI failed to take appropriate, prudent, and timely steps to protect its workers at the Plant from known excessive exposures to Cr-6-bearing residues.

Basis of Opinion

NPRC/CSCC knew, or had ample reason to know of the serious health risks posed to its Plant workers by exposure to chromate wastes as early as the late 1930s or 1940s. It had detailed and confidential knowledge of the serious adverse health effects from exposure to chromate dust in the Plant by the early 1950s. Despite this knowledge, it failed to take reasonable effective steps to mitigate these risks. Most of the recommendations from the Industrial Hygiene Foundation and United States Public Health Service studies from the 1940s and 1950s were apparently never implemented. This is evidenced by the history of employee health problems and compensation

claims that continued steadily from at least the 1940s until well after the Plant was shut down in 1963. NPRC and CSCC did not suggest at any time that either considered the Government responsible for ameliorating such conditions or implementing worker protection measures.

Unpleasant and unhealthy conditions for Plant workers during WWII were at least partly responsible for NPRC's inability to attract and retain labor at the Plant during the war.¹⁶ Another WWII Government document cited a total shortage of 200 men among 5 of the 6 chromate plants (one of which was the NPRC Plant) and blamed the shortage, in part, on poor working conditions.¹⁷

CSCC also had extensive private data on the presence and distribution of Cr-6 laden dust in many of the Plant operations areas in the mid- to late 1950s. A quarterly Cr-6 monitoring report for the Plant in 1957 concluded that conditions at the plant have not improved since the summer of 1956 and some parts of the Plant had higher concentrations.¹⁸ An internal report by John LaPallo (04/30/1958) reports that the inside of the Operations Building was coated with Cr-6 dust and that much Cr-6 dust was being circulated in air during full operation (presenting a health hazard to workers) [PPGNPR0032604-608]. Another internal report by Mr. LaPallo (07/03/1958) concluded that Cr-6 dust had worsened in some areas and there was much evidence of sloppy, unsafe conditions and practices [PPGNPR0032609-612]. He stated further that, "*It is quite evident from the data presented that most operating stations discharge a large amount of hexavalent chromium dust.*" He concluded that carelessness of workers was a factor and that PPGI was not making an effort to improve conditions.

Monitoring of Cr-6 dust in the various Plant areas continued into the early 1960s and showed no significant improvements. For example, a 1962 PPGI report indicated that, while the Plant was in full operation, there was only one situation where the chromium level fell below the recommended maximum of 0.1 mg Cr-6 (as CrO₃) per cubic meter of air.¹⁹ At some locations, the standard was exceeded by more than a factor of ten.

As another example, an internal 1959 PPGI memorandum²⁰ requested authorization for construction of new chromate production facilities at Corpus Christy, Texas, "*...because the Jersey City plant has insufficient capacity, is obsolete, uneconomic, and is a health hazard to employees and the community*" (emphasis added). This indicates that NPRC/CSCC/PPGI avoided for many years taking appropriate steps to improve workers health conditions and environmental hazards posed by the plant because of costs. PPGI apparently concluded that it was more cost effective to build a new plant than to make improvements in the Jersey City Plant.

PPGI concluded in another 1959 internal document that it was more economical to build a new chromate plant in Corpus Christy, Texas, than to spend the estimated \$1 million or more that would be required to make its Jersey City Plant safe for workers and environmentally acceptable,

¹⁶ United States Government memorandum Summary of Meeting of the Chromium Chemical Labor Task Force, 11/06/44 [COMP0000625-632]

¹⁷ Industrial Briefs No. 34, 1944 [PPGNPR00013973-978]

¹⁸ Airborne Hexavalent Chromium Jersey City Plant, by J.U.S. Gouin, 04/30/1957 [PPGNPR0033324-328]

¹⁹ Airborne Hexavalent Chrome (Jersey City Plant), by Jack Koplen, 09/06/1962 [PPGNPR0064474-77]

²⁰ Columbia Southern Chemical Corporation memorandum, 11/27/1959 [PPGNPR0032366]

indicating that saving money was more important to NPRC than worker safety and environmental protection [PPGNPR0032491-506].

PPGI became well aware of health problems suffered by its workers at the Plant through lost-time injury reports, accident reports, and insurance claims filed for injured workers from at least 1942 through 1965. In a 1947 court judgment for a workman's compensation appeal, a Plant worker was awarded \$300 disability suffered from chromium poisoning (perforated nasal septum) at the Plant.²¹ One list of payments made for bronchial and respiratory injuries indicates that about \$90,000 had been paid out to injured Plant workers from 1958 through 1964.²² A PPGI internal memorandum stated that \$63,880 had been paid out in the just the first 7 months of 1965 for claim settlements for chronic bronchitis and other pulmonary injuries suffered by Plant workers.²³ A series of more than fifty accident reports (mostly chromium exposure injuries) were filed with PPGI, the State of New Jersey, or insurance companies from December 1942 to August 1962 [PPGNPR0076908-77118]. PPGI worker injury claim documents indicate that just during the two-year period of 1957-1958, at least 65 injury claims related to chromium exposure were filed by Plant workers and that about \$48,800 was paid out to those workers as compensation [PPGNPR0077183-7215].

A 1955 letter from the Industrial Hygiene Foundation to T.R. Donoghue of PPGI transmits a report on the studies that IHF had conducted at the Plant regarding worker exposures to Cr-6 dust.²⁴ The letter states, "*The findings indicate the need to instituting a program of general plant improvements to lower concentrations of hexavalent chromium.*" Several specific priority suggestions for improvements followed. I found no evidence that most of those suggestions were implemented by PPGI. That is supported by the fact that periodic monitoring of Cr-6 levels in Plant air did not show significant improvements between 1955 and 1962 (as pointed out above), and that Cr-6-related injury claims by employees appear to increase between 1955 and 1965 (as pointed out above).

Studies by the IHF continued at the Plant in 1956-1957, with additional reports and recommendations [PPGNPR0068255-271]. Recommendations included the following:

- All workers in dust control areas wear respirators
- Give serious consideration to providing mechanical local exhaust ventilation for packing operations in the neutral chromate building (Building No. 2)
- Inform workers of importance of good personal cleanliness

It repeated the recommendation to install local exhaust hoods which had been made previously (1955) but not implemented. In PPGI's answers to the United States' First Set of Interrogatories [PPGNPR0088221-295], Interrogatory No. 81, PPGI replied that it was unaware of any warnings it had issued to employees subject to exposure to chromium.

²¹ Court judgment document, George Koval v. Natural Products Refining Corp., 01/31/1947 [PPGNPR0034980-81]

²² List of bronchial and respiratory payments for PPGI workers, 11/25/64 [PPGNPR0071014]

²³ PPGI Memorandum from D.B. Dailey to S.R. Papp re/ Workmen's Compensation Summary, 08/05/1965 [PPGNPR0071173]

²⁴ Letter to T.R. Donoghue, Pittsburgh Plate Glass Co., from T.F. Hatch, Industrial Hygiene Foundation, 03/22/1955 [PPGNPR0037190-91]

A 1959 internal PPGI memorandum discussed projects related to:

- Air pollution abatement
- Dust control systems
- Air conveying system
- Kiln building improvements
- Wet scrubbers for kiln gasses

The letter shows that only minor progress had been made in addressing the air quality problems over the past four years and that additional steps are still needed to solve the pollution problems [PPGNPR0082685].

An internal PPGI memorandum (06/22/1984) regarding chromium contamination and safety practices at the Plant states, *“When PPG Industries began the operation of the chrome plant, safety rules were poorly enforced and there was lack of safety equipment. As late as 1957, the wearing of safety glasses was haphazard and hard hats were not being worn. Dust masks were simple, cheap paper.”* [PPGNPR0557613-641].

2. PPGI intentionally discharged Cr-6-laden airborne particulate emissions to the atmosphere of Hudson County and this dust became fallout on its own property as well as surrounding properties within the County. NPRC and CSCC did not suggest at any time that it considered the Government responsible for such discharges.

Basis of Opinion

A 1990 Directive by NJDEP states that on May 4, 1950, the Jersey City Board of Health filed a complaint for allowing offensive dust to be emitted from PPG’s Garfield Avenue chromate facility and, *“At least as early as 1950, PPG knew that dust leaving the Garfield Avenue site was contaminated with chromium.”*²⁵ The Directive goes on to state that, *“At least as early as the mid-1950s, PPG was aware that chromium present in its chromate chemical products waste posed a health risk and instructed its employees to wear protective clothing while handling the waste.”*

Studies conducted at the Plant and at other chromate chemical plants in the late 1940s to mid-1950s identified numerous sources of chromium-bearing airborne dust emissions that presented significant health hazards to employees (see Opinion 4.4-10 below, for details).

An internal study of chromium-laden dust problems in 1957 stated, *“...it can be concluded that the soda building, hydrate building, kiln building, leach building and mill building are unsafe areas [based on excessive Cr-6 levels in the air].”*²⁶

Another internal PPGI memorandum states, *“At present, we [PPG] are polluting the atmosphere by discharges of approximately 15,820 pounds per 24 hours by solid entrainment in the mud*

²⁵ Hudson County Chromate Chemical Product Waste Sites Residential Sites Directive by NJDEP, 05/16/1990

²⁶ Report I Airborne Hexavalent Chrome Jersey City Plant, by J.U.S. Gouin, 01/10/1957 [PPGNPR064461-62]

*dryer and kiln exit gases. This represents a neighborhood nuisance and has been the source of public complaints,”*²⁷

No evidence has been found to suggest that NPRC or CSCC considered the Government to be responsible for these discharges.

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

3. PPGI failed to take reasonable and timely steps to reduce or eliminate airborne Cr-6-laden particulate emissions from its Plant. NPRC and CSCC did not suggest at any time that it considered the Government responsible for such discharges.

Basis of Opinion

The PPGI Plant was designed to exhaust air and other gasses with entrained chromium-bearing particulate solids to the atmosphere through stacks and vents. A 1989 site investigation report [PPGNPR161176-1402, Attachment M] states that the PPGI Plant has five main sources of contamination of outdoor air (from samples collected by the United States Public Health Service in 1949 or 1950):

1. Kiln stack discharge and residue dryer discharge
2. Mill building vents – much dust
3. Sodium bichromate dryer exhaust stack
4. Sodium sulfate dryer discharge stack
5. Residue and ore stock piles – depends on weather conditions

The report also states that the New Jersey Department of Health also did air sampling near the Plant in 1950 and found chromium in particulates.

In a 1990 Directive, the NJDEP concluded that, *“At least as early as 1950, PPG knew that dust leaving the Garfield Avenue Site was contaminated with chromium.”*²⁸

An internal PPGI report in 1957 describes results from dust sampling in the Plant in 1956. It states, *“...it can be concluded that the soda building, hydrate building, kiln building, leach building and mill building are unsafe areas.”* (because of airborne Cr-6 laden dust) [PPGNPR0064461-62].

Another internal PPGI document reports results of a chromium dust survey conducted at the Plant in 1962. It concluded that there was only one situation where the airborne hexavalent chromium level fell below the recommended maximum of 0.01 mg/m³ CrO₃ [PPGNPR0064474-77].

²⁷ PPG Memorandum from D.B. Dailey to D.R. Dunham, 05/03/1957, regarding Air Pollution Abatement [PPGNPR075601-602]

²⁸ Hudson County Chromate Chemical Production Waste Sites Residential Sites Directive, by NJDEP, 05/16/1990 [PPGNPR137158-186]

A 1957 news release indicates that CSCC installed new air emissions reduction equipment in 1957 to reduce Plant dust emissions to the atmosphere by 90 percent [PPGNPR0033310]. This was done at the request of the Jersey City Health Officer. NPRC and CSCC were well aware of the nuisance and adverse environmental impacts of the Plant's chromium laden particulate emissions for years, but did nothing until pressured by a local health authority. These improvements could have easily been made years earlier. It is also clear that these improvements were ineffective in making major reductions in worker exposures to Cr-6 dust or Cr-6-related injuries suffered by workers, as pointed out above in the Basis for Opinion 4.4-1.

Former PPGI employee, Fredrick Froehling, testified in deposition that he could not recall authorizing expenditures for equipment to reduce air emissions at the Plant²⁹. He also testified that a request had been made by two Plant officials to make Plant improvements related to air quality improvements in 1957 and that some improvements were made, mainly to improve production. This indicates that PPGI more concerned with improving production and profit than with protection of Plant workers' health and environmental protection.

An internal document by former PPGI employee Fredrick J. Froehling (circa August 2, 1957) presents an economic cost/benefit analysis of potential modernization steps to the Plant to resolve dust emission concerns [PPGNPR0063741-743]. It concludes that such improvements are not economically feasible. It states further that PPGI is being "*harassed by neighbors about dust, etc.*" It then states that PPGI will add new production techniques and locations "*(if made necessary by the dust problem)*".

A 1959 internal PPGI memorandum discussed projects related to:

- Air pollution abatement
- Dust control systems
- Air conveying system
- Kiln building improvements
- Wet scrubbers for kiln gasses

The letter shows that only minor progress had been made in addressing the air quality problems over the past four years and that additional steps are still needed to solve the pollution problems [PPGNPR0082685].

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

4. PPGI failed to respond in an effective manner to complaints from the surrounding community regarding its chromium-bearing airborne emissions. NPRC and CSCC did not suggest at any time that it considered the Government responsible for responding to or addressing such complaints.

Basis of Opinion

²⁹ Exxon Corp. v. PPG Industries, Inc., 01/12/1991, pp. 73, 75, and 118 [PPGNPR0063393-575]

An internal PPGI memorandum dated 05/03/1957, states, “*At present, we [PPGI] are polluting the atmosphere by the discharge of approximately 15,820 pounds per 24 hours by solid entrainment in the mud dryer and kiln exit gases. This represents a neighborhood nuisance and has been the source of public complaints.*”³⁰ Former PPGI employee, Fredrick Froehling testified in deposition that towns people complained to the Plant superintendent during his stint there.³¹

In a 1990 Directive, the NJDEP stated that On May 4, 1950, the Jersey City Board of Health filed a complaint against PPGI for allowing offensive dust to be emitted from PPGI’s Garfield Avenue chromate facility and concluded that, “*At least as early as 1950, PPGI knew that dust leaving the Garfield Avenue Site was contaminated with chromium.*” [PPGNPR0137158-186].

Other 1950s CSCC documents discuss how CSCC alone decided on the extent to which it would and would not install atmospheric pollution abatement equipment to address conditions within and near the plant. [PPGNPR008921; PPGNPR0835831-35; PPGNPR0075601-02; PPGNPR0557509-10; PPGNPR0033310; PPGNPR0082652-53; PPGNPR0661431; PPGNPR0664158; PPGNPR0664162; PPGNPR066416; PPGNPR0082663; PPGNPR0082670; PPGNPR0082685-87].

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

5. PPGI stored its CCPW/COPR in piles on bare ground, exposed to the elements, which led to the contamination of hundreds of thousands of tons of residual waste material, soil, and building materials which require remediation. PPGI took no effective measures to prevent adverse impacts to the environment from its waste management practices.

Basis of Opinion

The following documents provide basis for this opinion: Remedial Investigation Work Plan Garfield Avenue Site 114, Jersey City, New Jersey, by ENSR Corp., April 2003 [PPGNPR0017185-216]; Remedial Investigation Work Plan – Soil Non-Residential Chromate Chemical Production Work Sites 114, 132, 133, 135, 137 143, 186, by AECOM, March 2011, [PPGNPR0019747-20030]; Interim Remedial Measures Work Plan #2, by AECOM, 07/26/10 [PPGNPR0019575-582]; Hudson County Chromate Chemical Production Waste Sites Residential Sites Directive, by NJDEP, 05/16/1990 [PPGNPR137158-186]; PPGI Memorandum from Chester Milczarek to Susan Kuis, 06/22/1984 [PPGNPR0557613-641]; Remedial Action Work Plan (Soil) Revision 1 Garfield Avenue Group – Sites 114, 132, 133, 135, 137, and 143, by AECOM, [PPGNPR0020259-354].

6. PPGI knew that its unprotected CCPW would release Cr-6 to the environment by way of runoff and seepage to underlying soil and groundwater. It also learned in the 1950s that Cr-6 was, in fact, being leached from unprotected waste piles.

³⁰ Internal PPGI memorandum from D.B. Dailey to D.R. Dunham re/ Air Pollution Abatement, 05/03/1957 [PPGNPR075601-602]

³¹ Fredrick Froehling deposition, Exxon Corp. v. PPG Industries, Inc., 02/12/1991, p. 75

Basis of Opinion

See Opinion 4.2-6 above.

NPRC/CSCC/PPGI had chemists at the Plant who understood and monitored the chemical processes that were used to convert chromite ore into chromate products. One of the key steps in the process was the leaching with water of the Cr-6 from the pulverized ore after roasting. The Plant chemists knew that the leaching step was not 100 percent efficient – leachable chromium remained in the “mud” after the leaching step. For that reason approximately 60 percent of the incompletely leached mud was mixed with freshly ground raw ore returned to the roasting step. The remaining 40 percent, or so, of the incompletely leached mud was discarded on-site as waste. Plant chemists would clearly have understood that the discarded mud still contained leachable chromium which would be released to the environment by percolating precipitation. See Opinions 4.1-3 and 4.2-6 above.

7. Until forced by the New Jersey Department of Environmental Quality (NJDEP) starting in 1984, PPGI took no steps to reduce or control the known leaching of soluble Cr-6 from unprotected on-site and off-site CCPW deposits. Even after enforcement actions began in the 1980s, and more than 30 years later, PPG has still not completed its cleanup actions at the sites identified in its complaint, and will not be finished by its own estimates for another several years.

Basis of Opinion

This conclusion is supported by the summary time line of regulatory enforcement history listed in the 07/19/1990 NJDEP Administrative Consent Order to PPGI [PPGNPR0029975-30347] and other NJDEP documents, the NJDEP 2005 lawsuit against PPG and others, and documents relating to the 2009 Partial Consent Judgment and events subsequent to that judgment in that litigation. See Expert Report of Dr. Jan Kool.

8. NPRC and CSCC actively and intentionally caused the spread of its toxic chromium-bearing wastes to many locations throughout Hudson County, NJ, by sale and gift, in addition to its own Plant property.

Basis of Opinion

See Expert Reports of Dr. Joan K. Meyer and Dr. Jay L. Brigham (Section VI).

CSCC/PPGI sold and gave away CCPW stockpiled at its Plant to outside parties that hauled the waste to off-site properties throughout Hudson County for use as construction fill. Purchases of this wastes are documented in numerous invoices and other sources.

9. Adverse health effects to chromate chemical industry workers in Europe were known as early 1827, and in the United States (at least at a Baltimore, Maryland, chromate production plant) as early as 1833.

Basis of Opinion

A 1955 study by the United States Public Health Service (USPHS) reviewed the history of documented adverse health effects among workers in the chromate chemical industry.³² The report states that the first reported health effects in chromate workers was in 1827 for dry workers in Scotland. Chromate-caused skin ulcers were reported for chromate chemical workers in a Baltimore, Maryland, plant in 1833.

10. The link between serious adverse health impacts, including lung cancer, to workers exposed to chromate-bearing dust in chromite ore processing plants (such as the former PPGI Jersey City Plant) was generally known in chemical industrial and public health circles by at least the early 1940s. The link between Plant worker exposure to chromate-bearing airborne dust and lung cancer and other serious ailments at the former PPGI Plant was known to NRC by at least 1948. The cancer risk to workers at the Plant was known to PPGI by 1954, when its former subsidiary, Columbia Southern Chemical Co., acquired the Plant from NRC.

Basis of Opinion

The following documents provide basis for this opinion: *Evaluation of Health Hazards Due to Chromium Compounds in Chromium Ore Reducing Plants in the United States*; by T.R. Thomas and H.E. Seifert, United States Public Health Service for the United States War Production Board, November-December 1943 [COMP00658-672]; *Cancer in the Respiratory System in the United States Chromate-Producing Industry*; Public Health Service Reports, v. 63, No. 35, August 27, 1948 [COMP00480-493]; *Health of Workers in Chromate the Chromate Producing Industry*, by United States Public Health Service, 03/18/1955 [PPGNPR0031,751-31, 903]; PPGNPR0034980-81]; [PPGNPR0076908-77178; PPGNPR0076747-76903; PPGNPR0090386-90452; PPGNPR0090839-40; PPGNPR0090988-91175; PPGNPR0091730-767; PPGNPR0091968-91971; PPGNPR0092123; PPGNPR0092234-235]; *Protection of Workers Exposed to Chromium and Its Compounds*, by Met-Life Insurance Co., January 1953 [PPGNPR0031556-580]; *Control of Health Hazards at Jersey City Plant of Columbia Southern Chemical Corporation – Preliminary Survey*, by Industrial Hygiene Foundation of America, Inc., 09/29/54; *Report on Airborne Hexavalent Chromium Concentrations in the Columbia Southern Chemical Plant, Jersey City, New Jersey*, November 30-December 17, 1954, by Industrial Hygiene Foundation of America, March 14, 1955 [PPGNPR0032,067-126]; *Supplemental Report to Columbia Southern Chemical Corporation, Subsidiary of Pittsburgh Plate Glass Co., Jersey City, New Jersey, Epidemiological Study of Chromate Workers*, by Industrial Hygiene Foundation of America, Inc., 1956; *An Epidemiological Study of Environment and Health of Chromate Workers*, by Industrial Hygiene Foundation of America, December 1957 [PPGNPR0032,127-196]; *Real Estate Sales Agreement*, 07/13/1964 [PPGNPR0031904-916]

See also Expert Report of Dr. Jay L. Brigham (Sections V and VI).

4.5 Opinions relating to financial benefits gained by NRC and CSCC, as might relate to equitable allocation factors for the Court's consideration

1. NRC and CSCC benefited financially from the sale of chemical products throughout the operational history of the plant.

³²*Health of Workers in Chromate Producing Industry*, United States Public Health Service, 153 pp., 03/18/1955 [PPGNPR0031,755-903]

Basis of Opinion

See also Expert Reports of Dr. Jay L. Brigham (Section VI) and Dr. Joan K. Meyer.

Corporate stock purchase documents regarding PGI's purchase of NRPC in 1954 indicate that NRPC had generally steady and growing gross annual sales from \$721,738 in 1933 to \$2,958,312 in 1953 [PPGNPR0089447-449]. The plant continued to be profitable for PPGI in other years.

2. CSCC benefitted financially from the sales of its Jersey City plant property parcels.

Basis of Opinion

Real Estate Sales Agreement, 13 pp., 07/13/1964 [PPGNPR0031904-916]; Jersey City Development Authority v. PPG Industries, Inc., answers to Defendant's interrogatories numbers 20 and 24, 08/05/1986. [PPGNPR0057020-53].

See also Expert Reports of Dr. Jay L. Brigham (Section VI) and Dr. Joan K. Meyer.

3. PPGI benefitted financially from the off-site spread of its CCPW by selling the waste as construction fill. It also benefitted financially by failing to spend funds for improvements needed to properly manage its waste streams and control airborne pollution.

Basis of Opinion

Many documents indicate that PPGI sold its CCPW for off-site use. For example, a 1984 internal PPGI memorandum states that the waste mud stored on-site was mostly sold at 10 cents to 50 cents per yard and that some was given away [PPGNPR0557613-641]. The same document indicates that 59,000 cubic yards of the CCPW mud was stockpiled on the ground at the Site when PPGI took over in 1954. The memorandum also indicates that an additional 148,000 cubic yards of mud were generated by PPGI from 1954 to 1963. In addition, PPGI benefitted at the time by not having to pay for disposing of the waste at some other off-site location.

See also Expert Reports of Dr. Jay L. Brigham (Section VI) and Dr. Joan K. Meyer.

4.6 Opinions relating to PPGI's conduct in investigating and cleaning up the environmental contamination caused by its Plant, as might relate to equitable allocation factors for the Court's consideration

1. PPGI began investigating the Plant site and other sites at issue in this case in the early-1980s, only after being pressured to do so by the Jersey City Hazardous Waste Task Force and the NJDEP.

PPGI failed to respond in timely and effective ways to investigate and clean up the widespread contamination caused by its CCPW at and near its Plant and elsewhere in Hudson County. The NJDEP 1990 Administrative Order on Consent with PPGI did not result in the cleanup of the

Plant site and other sites at issue in this case, and these sites were included in NJDEP's 2005 lawsuit against PPGI and others, resulting in a 2009 Partial Consent Judgement against PPGI.

Basis of Opinion

In its answers to plaintiff's interrogatories in a 1986 litigation case (Jersey City Development Authority v. PPG Industries, Inc., 08/05/1986), PPGI stated in its answer to interrogatory number 44 that PPGI became aware of chromium contamination on the ground surface in October 1981 from sampling and chromium in groundwater in January 1984. [Cite]

PPGI Interoffice correspondence re/ a site visit by PPGI representatives, 11/02/1981 [PPGNPR0089384-86]; this document states that the existence of soluble hexavalent chromium is evident in the waste storage area and in other areas. These area "*show patches of chromium yellow efflorescence characteristic of soluble chromium contamination. Runoff from these areas flows to city storm sewers and into upper New York Bay (Lower Hudson and North Rivers).*" It states further that the site chromium waste storage area "*likely qualifies for notification [to the EPA or NJDEP under CERCLA or RCRA rules].* However, the author does not recommend notifying the EPA, but recommends continued surveillance by PPGI "*until the plant site is visited*" [by EPA]. [PPGNPR0089427-430]

See also Letter from PPGI to Lawrence Construction Co., 07/28/1982 [PPGNPR00131879]; [PPGNPR0064426]. It has known of potential regulatory concern over soil and groundwater contamination at the Plant site since at least 1981 [PPGNPR0089427-430]. PPGI expressed its awareness of the environmental threat posed by the property after it had sold it, because it warned Lawrence Construction Co. (buyer) of the potential problems in a letter, stating that "*It would appear that the property may pose an environmental concern for which our firms and possibly others, may share responsibility.*"

PPGI has known of NJDEP's directives, orders, or requirements to remediate the environmental contamination caused by its wastes since at least January 1984.

PPGI has unnecessarily drawn out the investigations and cleanup actions at the sites of concern over a period of more than 34 years (1982-2016) and has still not completed the requirements of the NJDEP directives and agreements. This extraordinarily delayed action sequence is clearly reflected in the litany of dozens of NJDEP directives, inquiries, and criticisms, as well as the list of scores of draft work plans, work plans, draft remedial investigation reports, remedial investigation reports, draft interim remedial action reports, etc. Many of these documents are listed in major PPGI investigation reports and NJDEP Directives.

For example, the 2003 Remedial Investigation (RI) Work Plan for Site 114 (former PPGI plant site) lists five enforcement actions that were taken by NJDEP between January 1985 and July 1990. It also lists twelve remedial actions that had been done just for Site 114 alone between November 1987 and fall 1992. This implies that no remedial actions were done between fall of 1992 and the preparation of the 2003 RI Work Plan. It also shows that it took PPGI nearly 20 years just to get to the point of preparing the RI Work Plan (which should have and could have been completed many years earlier). The RI Work Plan has to be completed and approved before the selected remedial action can be implemented.

Additional support for this opinion include the following: Directive letter from NJDEP to PPGI, 01/31/1984, directs PPGI to initiate remedial measures for Cr-6 on several parcels of land owned by Jersey City Redevelopment Agency and the City of Jersey City [PPGNPR0075719-20]; Remedial Investigation Work Plan Garfield Avenue Site 114 Jersey City, New Jersey, by ENSR Corp., April 2003 [PPGNPR0017185-216]; Hudson County New Jersey Chromium Remediation Projects – A. Non-Residential Sites Remedial Investigation, B. Non-Residential Sites Interim Remedial Measures, Semi-Annual Report, by PPGI, 08/01/2001 [PPGNPR132640-651]; Interim Post-Remediation Management Plan Garfield Avenue Group Sites 114, 132, 133, 135, 137, and 143, (Draft), by AECOM, April 2012 [PPGNPR0550164-0200]; Baseline Ecological Evaluation PPG Garfield Avenue Group – Sites 114, 132, 133, 135, 137, 143, and 186 Jersey City, New Jersey, by AECOM, May 2011 [PPGNPR0252571-617]; [PPGNPR0019747-20090, PPGNPR0020259-354]. Remediation of Site 114 still had not been completed by the end of 2015.

See Expert Report of Dr. Jan Kool (Sections 3, 4, and 5).

2. PPGI's prolonged and protracted environmental cleanup efforts over a period of more than 35 years have exacerbated the environmental damage and increased exposures of humans and ecosystems to chromium from its wastes through the spread of contamination from sites described by PPGI in its complaint.

Basis of Opinion

As explained above, PPGI has unnecessarily delayed the investigation and cleanup of its chromium contaminated sites for decades. These delays have allowed Cr-6 to continue to spread in soil and groundwater, thus contaminating larger areas and volumes of soil and groundwater. This, in turn, has increased the magnitude and costs of investigations and remedial actions. Cr-6 is soluble and mobile in wet subsurface environments. It moves slowly with flowing groundwater and by diffusion in the unsaturated zone.

4.7 Opinions related to the environmental behavior and fate of chromium

1. Of the two primary chemical forms of chromium associated with the PPGI wastes (Cr-3 and Cr-6), Cr-6 (the most toxic form) is more soluble and therefore the most mobile in soil and groundwater. In the absence of chemically-reducing conditions, Cr-6 will remain in the hexavalent (most toxic and mobile) form indefinitely in air, soil, surface water and groundwater.

Basis of Opinion

Total chromium concentrations are typically three to five times greater than Cr-6 concentrations in contaminated soil associated with Plant wastes. In general, Cr-6 in groundwater is soluble and mobile and Cr-3 will be relatively insoluble and immobile. Cr-6 tends to remain stable in this oxidized state in the absence of chemically reducing conditions. Chemically reducing conditions can occur in soil and groundwater in the absence of oxygen (dissolved or gaseous), high concentrations of organic carbon, the presence of other reducing agents (such as ferrous iron),

low oxidation potential (Eh), and relatively low pH.³³ Remedial investigation studies in the Site area have shown that dissolved chromium in groundwater is in the Cr-6 state [See, e.g., PPGNPR0282293-448].

2. Because of its relatively high mobility in the environment, Cr-6 tends to migrate away from release areas into less contaminated zones, vertically and horizontally. Thus, the longer Cr-6 is left unremediated in the environment, the greater the area and volume of contaminated soil, sediment, and groundwater becomes. This, in turn, increases the costs of investigations and cleanup.

Basis of Opinion

Dozens of environmental investigations conducted at and near the Plant site, as well as other sites at issue in this case have shown that Cr-6 has spread widely in groundwater from source areas. For example, the 2011 Site Investigation report for the PPGI proposed Morris Canal Berry Lane Park, shows that elevated Cr-6 concentrations groundwater exceed the NJDEP target cleanup standard of 70 micrograms per liter at numerous properties up to several hundred feet away from the Plant site [PPGNPR0261076].

A 2009 Remedial Investigation Work Plan for non-residential chromium site in Hudson County contaminated with PPGI's CCPW stated that nearly all chromium in groundwater is Cr-6 and the three-fourths of groundwater samples exceeded NJDEP's health-based guideline of 70 micrograms per liter.³⁴

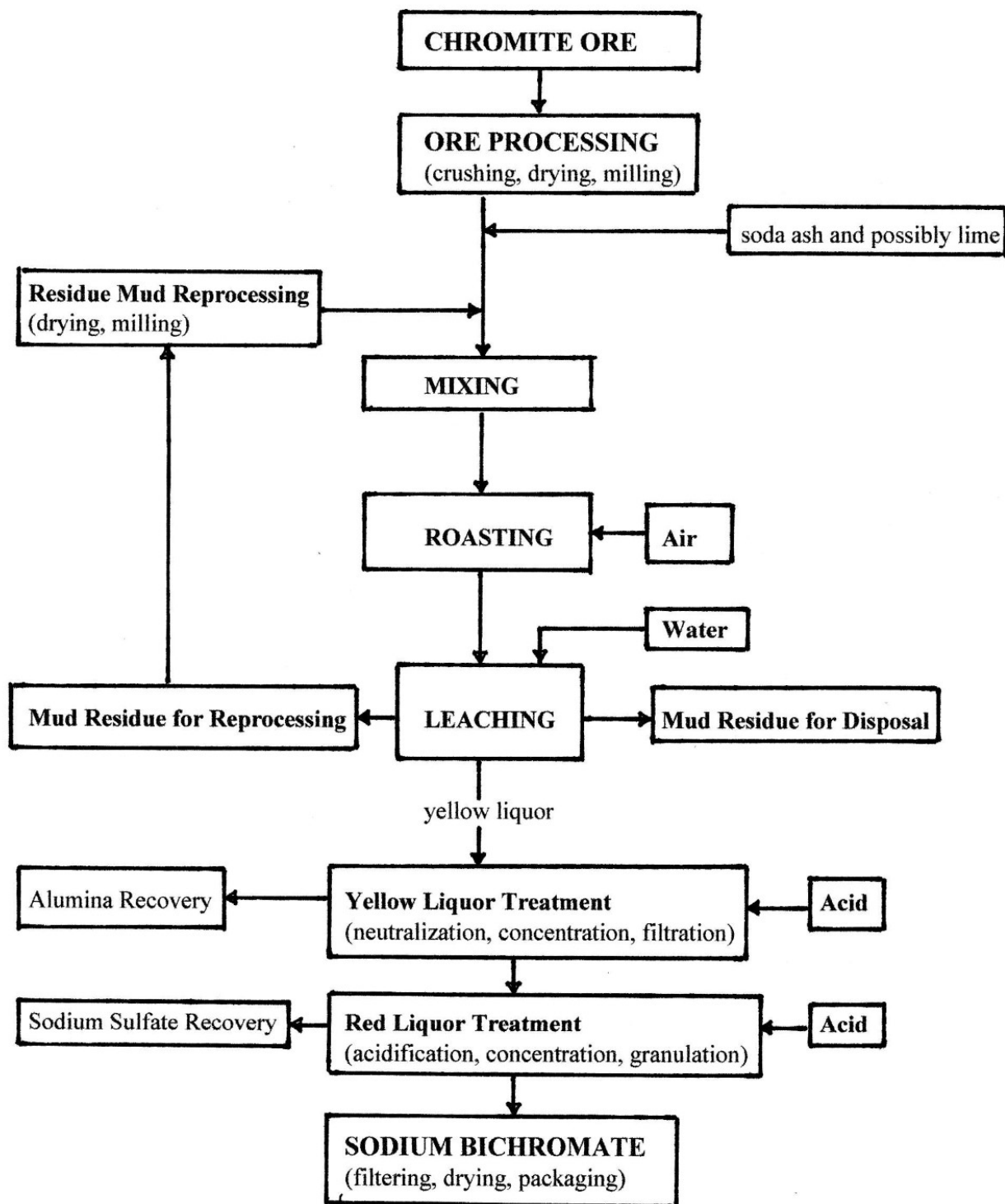
4.8 Summary of Opinions regarding equitable allocation of cleanup costs

1. The evidence supporting the opinions presented above collectively indicates that the Government played no role in contributing to the contamination caused by PPRC's and PPGI's activities at the Plant or the management and disposal of wastes from the Plant. I have reviewed no evidence that indicates that the Government ever met any of the factual criteria on which CERCLA liability has been based (facility owner, facility operator, waste disposal arranger, or waste transporter). Therefore, the Government should bear no share of responsibility for cleanup costs associated with this Plant and its wastes. However, if some basis for Government liability were to be found, the available evidence warrants the conclusion that no share of responsibility for cleanup costs associated with this Plant and its wastes should be allocated to the Government. Such a result has been reached in other cases where a private party or the Government has been held liable.

³³ Contaminant Hydrogeology, by C.W. Fetter, pp. 295-297, Prentice Hall, 1999.

³⁴ Remedial Investigation Work Plan Non-Residential Chromate Chemical Production Waste Sites 114, 121, 132, 133, 135, 137, 143, 186, and 207 Jersey City, New Jersey (Draft) by AECOM, July 2009, 56 pp. [PPGNPR282293-448]

Figure 1. Generalized flow diagram for the production of sodium bichromate from chromite ore, as employed at the former PPGI Jersey City, New Jersey, plant [based on PPGNPR0031777]



APPENDIX A

Curriculum Vitae of John B. Robertson

CURRICULUM VITAE

JOHN B. ROBERTSON, P.G.

Consulting Hydrogeologist/Hydrologist/
Environmental Scientist

Geological Engineering Degree (M.S. equivalent)

202 Aldersgate Court

Greenville, NC 27858

Cell Phone: 623-695-5919

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PROFESSIONAL EXPERTISE:

- Groundwater hydrology and general hydrology
- Earth-science technology applied to chemical and nuclear waste disposal
- Contaminant fate and transport in soil and groundwater, including radionuclides and organic chemicals
- Water supply/resource development
- Natural resource damage assessments regarding groundwater resources
- Waste disposal technology for low-level and high-level radioactive waste
- Expert testimony and litigation support for hazardous waste and groundwater resource cases
- Remedial technologies for sites with contaminated soil and/or groundwater
- Quantitative analysis and treatment of groundwater and soil contamination problems
- Industrial processes and associated wastes (contemporary and historical)
- Allocation of costs for environmental damage or harm cases
- Chemical-physical-biological interdisciplinary processes in soil and groundwater
- Assessment of aquifer hydraulic properties; aquifer test design and analysis
- Computer modeling of groundwater and contaminant transport systems
- Environmental assessment for commercial property transactions
- Hydrogeologic siting criteria and site assessment for hazardous waste and low-level nuclear waste sites
- Technical regulatory criteria for RCRA, CERCLA, radioactive wastes and related federal and state regulations
- Interpretation of aerial photographs for environmental and hydrologic conditions

EDUCATION:

Geological Engineer Degree, (M.S. equivalent) Colorado School of Mines, 1961

40 semester hours graduate training in hydrology, groundwater hydraulics, mathematics, geochemistry, and numerical methods - Colorado School of Mines, University of Arizona, and the University of Idaho

Graduate of U.S. Geological Survey training series on groundwater flow and solute transport modeling and other intensive USGS courses

Graduate of Federal Executive Institute program on executive leadership and management

PROFESSIONAL EXPERIENCE:

December 1999-Present: Principal Hydrogeologist/Environmental Scientist, John B. Robertson Consulting, 40107 N. 3rd St., Desert Hills, AZ 85086 (sole proprietorship).

June 1987-November 1999: Executive Vice President, Co-founder, and Principal Hydrogeologist, HydroGeoLogic, Inc., 11107 Sunset Hills Road, Suite 400, Reston, VA, 20190

1984-June 1987: Vice President, Director of National Ground Water Programs, Roy F. Weston, Inc., Weston Way, West Chester, Pennsylvania 19380.

1961-1984: U.S. Geological Survey, Water Resources Division (last position, Chief, Office of Hazardous Waste Hydrology, National Center, Reston, VA 22092).

RELEVANT PROJECT EXPERIENCE:

Highlights of professional experience relevant to groundwater hydrology, and contaminated site investigation/remediation:

- Former Program Coordinator of the U.S. Geological Survey nationwide program of nuclear and chemical waste disposal studies and groundwater contamination research and data collection, including coordination of interagency activities with the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), U.S. Department of Defense Agencies (DOD), and U.S. Nuclear Regulatory Commission (NRC).
- Senior technical reviewer and advisor to US DOE on site characterization plans for candidate high-level and plutonium waste repositories in the United States, including the Basalt Waste Isolation Project, Hanford, Washington; the Yucca Mountain site, Nevada; and the WIPP site in New Mexico.
- Senior expert reviewer for DOE of Environmental Assessments, Site Characterization Plans, and related documents for proposed high-level nuclear waste disposal sites.
- Served as expert consultant and/or witness for more than 40 environmental litigation cases involving groundwater and soil contamination, site investigation, site remediation, groundwater resource development, natural resource damage assessment, compliance with environmental regulations, contaminant fate and transport, industrial waste streams, and remedial cost estimation.
- Currently serving as Cost Allocator to the Arizona Department of Environmental Quality and the Arizona Attorney General's Office for state-lead super-fund-type sites.

- Former Program Manager for several multi-site programs involving environmental investigations, remediation, potentially responsible party searches, and cost allocation for U.S. Department of Defense sites.
- Reviewed numerous other RI/FS documents for several industrial, municipal and federal waste/contamination sites, including sites with radiological contamination.
- Extensive experience with and understanding of CERCLA/SARA/NCP, RCRA, radioactive waste environmental regulations and guidance regarding site investigations and remedial requirements
- Served as expert advisor to USEPA Region VII on Hastings, Nebraska superfund site; performed review, analysis and comments on numerous RI/FS and related documents.
- Co-authored widely-used text book on remedial technologies for contaminated soil and groundwater.

Served as a testifying expert witness in more than 25 environmental litigation cases, including the following key examples:

- Travelers Indemnity Company, et al., v. Northrop Grumman Corporation, et al.; testified for plaintiffs in deposition 2013 (environmental damages insurance claim dispute); plaintiffs' summary judgment motions for dismissal granted.
- TDY Holdings, LLC and TDY Industries, Inc., v. The United States of America, et al.; testified in trial, US District Court, Southern District of California, San Diego, April-May 2012; cost allocation dispute over cleanup costs for contaminated former aircraft manufacturing plant site.
- BASF Catalysts LLC (f/k/a Engelhard Corporation) v. Allstate Insurance Co. et al.; insurance coverage dispute that went to trial in New Brunswick, NJ, December 2010; testified in trial (State Superior Court) regarding causes and timing of uranium and other heavy metal contamination of soil, sediments and groundwater; Court's judgment was favorable for the issues I addressed.
- State of Ohio v. US Department of Energy, et al.: claim by Ohio that USDOE caused natural resource damages to the Great Miami Aquifer system by contamination from the DOE Fernald uranium processing plant; testified in deposition, 2007; case settled.
- Raytheon Aircraft Co. v. United States: dispute in which Raytheon claimed the United States was responsible for the majority of groundwater and soil contamination at the former Herington Army Airfield Beechcraft Aircraft manufacturing facility, Herington, Kansas; testified in trial at US District Court, Kansas City, MO, 2008.
- Miami-Dade County, Florida v. United States: dispute over causes of groundwater contamination at Miami International Airport and responsibility for cleanup costs; testified in deposition and trial, US District Court, Miami, FL, 2005-6.
- State of Mississippi v. City of Memphis, TN, et al.: claim by Mississippi that Memphis has been appropriating groundwater that belongs to Mississippi; testified in deposition; case dismissed, 2008.
- United States v. DICO: Dispute over sources of contamination and responsibility for remedy; testified in deposition and trial, US District Court, Des Moines, Iowa.
- Dow Chemical v. United States: Dispute over causes of groundwater contamination on Oahu, HI, and responsibility for costs; testified in deposition, US District Court, Honolulu, HI; case settled.

- Dedham Water Co. v. Cumberland Farms: dispute over source of contamination in a municipal well field; trial testimony, US District Court, Boston, MA.
- Hardage-Criner Superfund Site, Oklahoma: Potential responsible parties v. United States; testified in deposition and trial, US District Court, Oklahoma City, OK.
- United States v. Atlantic Richfield (Sikes Superfund Site, Texas): Dispute over remedy decision, remedy costs, and cost allocation; testified in deposition.
- Port of Redwood City v. Gibson Environmental, et al.: Dispute over responsibility for cleanup costs at a contamination site in Redwood City, CA; testified by affidavit.
- Plaza Speedway v. United States: Dispute over cause of groundwater contamination and appropriate remedy, near Fr. Riley, Kansas; testified in deposition and trial, Superior Court, Kansas.
- Akhavan v. Hon Development, et al.: Dispute over causes of a landslide in Laguna Niguel, CA; testified in deposition; case settled.

OTHER RELEVANT EXPERIENCE

Project Chief of a research project on modeling radionuclide transport in groundwater at the Idaho National Engineering Laboratory; responsible for the first development and field demonstration of numerical models capable of simulating ground-water flow, hydrodynamic dispersion, radioactive decay, and sorption reactions in two dimensions.

Key project hydrogeologist for project at The Idaho National Engineering Laboratory to assess subsurface hydrogeologic conditions and extent of and potential future migration of waste products from the Radioactive Waste Management Complex (low-level waste burial site).

Conducted the first successful field validation of the USGS-MOC computer groundwater modeling code on two radioactive waste leachate plumes in groundwater at the Idaho National Engineering Lab, Idaho Falls, Idaho.

Program Coordinator of USGS nationwide studies of low-level nuclear waste disposal, including interagency coordination with NRC, EPA, DOE, and States; planned and supervised field studies on nine low-level radioactive waste disposal sites and supportive research.

Lead USGS review and commentator on NRC Nuclear Waste Disposal Rules such as 10 CFR 60 and 10 CFR 61, EPA proposed low-level and high-level nuclear waste disposal standards (40 CFR 191), Congressional legislation, such as the Nuclear Waste Policy Act, the Low-Level Radioactive Waste Policy Act, RCRA, CERCLA, and related legislation.

Participated in the design, conduct, and analysis of numerous aquifer tests to assess transmissivity, hydraulic conductivity, storage characteristics and other properties.

Program director for contract with major national petroleum company to assess environmental conditions at numerous sites in the Mid-Atlantic States. Supervised monitoring well installation and network design, directed cost-effective remedial action program for groundwater contamination from leaking underground gasoline tanks, negotiated with state regulatory officials, and related tasks.

Directed numerous environmental assessments for commercial property transactions to protect interests of lenders, buyers, and sellers.

Applied the USGS and other well-established groundwater flow and transport models to numerous field problems including:

- analysis and prediction of various waste plume migrations at the Idaho National Engineering Laboratory.
- analysis of groundwater flow systems at the Chem-Nuclear low-level waste disposal site near Barnwell, South Carolina (adjacent to Savannah River Plant).
- analysis of groundwater flow and waste radionuclide migration patterns in three dimensions at the Basalt Waste Isolation Project site, Hanford, Washington.
- analysis of groundwater flow characteristics and probable range of hydraulic parameters at proposed high-level nuclear waste repositories.
- analysis of potential impacts of leachate plume migration from several landfill sites on alluvial coastal plain sediments in Sussex County, Delaware. The results were used in support of regulatory agency resource management decisions.
- groundwater contamination of public supply well field by chlorinated organic solvents near Boston, Massachusetts.
- groundwater contamination at a pharmaceutical manufacturing site near Union, New Jersey. The model was used to support RI/FS study and remediation plan submitted to State Department of Environmental Protection.
- analysis of contaminant plume migration patterns and remedial feasibility studies at a chemical manufacturing site in Illinois. The results were used to support negotiations with regulatory agencies.
- assessment of groundwater flow and contaminant migration patterns at the River Bank Army Ammunition Plant in central California.
- analysis of chlorinated organic solvent contamination plume potential migration patterns and remedial options at a chemical manufacturing site in southern California.
- analysis of twelve multi-well pumping tests conducted on a large hazardous waste disposal site on fractured claystone in southern California.
- analysis of variably saturated flow conditions beneath a chemical waste impoundment to support a request for waiver of regulations (major chemical company site).
- groundwater contamination by wood-preserving chemicals in Visalia, California.
- organized and taught intensive short course on use of MODFLOW and MOC to hydrogeologists of a large, national consulting firm (Roy F. Weston, Inc.).
- analysis of contaminant plume migration patterns at a variety of other sites in various hydrogeologic environments.
- attended complete series of intensive USGS training classes on USGS-MODFLOW, and its pre- and postprocessors, USGS-MOC, SWIFT/SWIP, and other public domain codes.

Independent technical expert reviewer for completeness and technical adequacy of RCRA and CERCLA applications for variance waivers and permit applications.

Project Director of a study to assess potential impacts of the 1986 Safe Drinking Water Act amendments on a large nationwide industrial group.

Project Director of major study to assess vulnerability of groundwater to pesticide contamination in 1610 counties of the Eastern United States.

Project Director of four major projects to assess technology available for detection, prevention, and correction of leakage from underground storage tanks for American Petroleum Institute, Electric Power Research Institute, and Petroleum Marketers Association of America.

Project Director of a project to assess the quality of groundwater resources on a nationwide scale and a project to assess national trends in groundwater research.

Served as member of special national expert task force to assess potential significance of fractures in salt and associated rocks at candidate high-level nuclear waste repositories located in salt deposits.

Provided cost allocation analysis and advice to two private sector clients involved with a RCRA corrective action and a superfund site remediation.

Developed first version of USGS-MOC groundwater flow and solute transport model that incorporated radioactive decay and sorption reactions.

Project Chief of a research project on characterizing and modeling migration and fate of toxic organic contaminants in groundwater at actual field sites; directed drilling, sampling, well construction, well testing, and related activities.

Member of research team studying the physical, chemical, and biological processes affecting the behavior and fate of synthetic organic detergents and pesticide compounds in groundwater.

Design and installation of monitor well networks for the Idaho National Engineering Laboratory.

Development of groundwater sampling methods and devices.

Instructor at various courses on groundwater hydrology and on the design and conduct of groundwater contamination studies.

Chairman of several national symposia and workshops relating to groundwater contamination and waste disposal.

Member of several other national and international advisory panels and working groups on groundwater contamination and hazardous waste disposal.

Represented agency and Department of Interior as expert witness at Congressional hearings on waste disposal and groundwater quality issues.

PROFESSIONAL CERTIFICATION:

Registered Professional Geologist, State of North Carolina, No. 761

PROFESSIONAL AFFILIATIONS:

American Geophysical Union, Past Chairman, Groundwater Committee (1980s)
American Association for the Advancement of Science (past member)
American Society of Civil Engineers, Secretary Groundwater Committee (1997-98)
Society of American Military Engineers (former active member)
American Academy of Forensic Sciences

International Society of Environmental Forensics

PROFESSIONAL HONORS AND SPECIAL RECOGNITION:

"Best of Reston" award recipient, 2001; award for outstanding community service to the City of Reston, VA

Entrepreneur of the Year Finalist, Greater Washington DC Area, 1999

National Academy of Sciences Committee on Ward Valley California Low-Level Radioactive Waste Disposal Site

National Academy of Sciences Panel on Groundwater Contamination--Low-Level Radioactive Waste

U.S. Representative to the Coordinating Group on Geologic Disposal of Nuclear Wastes, Nuclear Energy Agency, Organization for Economic Cooperative and Development, Paris, France

Invited Member of two National Policy Development Committees for Low-Level Radioactive Waste Disposal

Recipient of U.S. Department of the Interior's Meritorious Service Award for advancing modeling technology for radionuclide transport in groundwater

Special Consultant to National Academy of Sciences Committee on Ground Water Protection

Chairman, Scientific Advisory Committee, National Center for Groundwater Research (US EPA)

Appointed Member of Virginia Solid Waste Commission by Governor Charles Robb

Invited Member of Several National and International Technical Advisory Panels

Listed in Who's Who Among Outstanding Americans (1994-95)

PARTIAL LIST OF PUBLICATIONS:

John B. Robertson, 2011. Determining the Primary Source and Time Period of Trichloroethylene Contamination in Groundwater – An Unusual Case History in which TCE Apparently Moved Faster than its Degradation Compounds (Abstract), Proceedings, American Academy of Forensic Sciences Annual Meeting, Atlanta, GA, February 2011.

Robertson, J.B., 2005. Who's Contamination is it? Distinguishing Groundwater Contamination Sources Using Chemical Signatures Combined with Hydrological Evidence (Abstract), Proceedings, American Academy of Forensic Sciences Annual Meeting, New Orleans, LA, February 24-25, 2005.

Robertson, J.B., 2004. Passing the Buck (Around) -- Using Forensic Environmental Evidence to Allocate Environmental Cleanup Responsibility and Costs Among Potentially Responsible Parties (Abstract), Proceedings, American Academy of Forensic Sciences Annual Meeting, Dallas, TX, Feb. 16-21, 2004.

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Attachment 2

**EXPERT REBUTTAL REPORT REGARDING THE EXPERT REPORT OF ROBERT
M. ZOCH, JR., P.E., DATED OCTOBER 7, 2016**

**PPG Industries, Inc. v. United States of America, et al.
United States District Court for the District of New Jersey
CA No. 2:12-cv-03526 (JMV) (MAH)**

Prepared by John B. Robertson, PG

**Prepared for the United States Department of Justice,
Environment and Natural Resources Division**

January 2017

Signature:

John B. Robertson

Date:

Jan. 06, 2017

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1.0 INTRODUCTION

I have been retained as an expert witness by the United States Department of Justice (DOJ) to provide expert review, analysis, advice, reporting and testimony within the areas of my expertise on the above-captioned case. My areas of expertise include environmental science; hydrology; industrial practices, processes, and waste streams; aerial photograph interpretation; technical requirements and criteria of environmental regulations; cleanup cost allocation in environmental disputes; government/industry relationships; and related matters. I previously prepared an expert report for this case which was submitted on October 7, 2016.

The DOJ has asked me to review the expert report submitted on October 7, 2016, by Plaintiff's expert, Robert M. Zoch, Jr., for this case and to prepare an expert report rebutting any of Mr. Zoch's opinions or bases thereof that I might find lacking appropriate scientific or factual support. This report presents my rebuttal opinions regarding Mr. Zoch's report.

I may revise or supplement the opinions and the bases therefor expressed in my October 7, 2016 Report and in this Rebuttal and Supplemental Report based on any expert rebuttal and supplemental reports submitted on behalf of PPG in this case, documents that PPG may produce hereafter in this litigation, the deposition and trial testimony offered by other experts on behalf of the United States herein or by experts on behalf of PPG, and any research made necessary by any of the foregoing.

My technical background, education, and experience are presented in my curriculum vitae which was included in my October 7, 2016, expert report, which is incorporated by reference with this report.

In his October 7, 2016, report, Mr. Zoch offered opinions regarding the following subjects or issues:

- Production wastes generated by the processing of chromite chromium ores into sodium bichromate and other chromate chemicals at the former PPG Industries, Inc., (PPG) plant in Jersey City, New Jersey (Plant), especially regarding the so-called chromium-containing mud residues generated from the leaching step of the production process
- Management and disposal of process wastes, especially the leaching mud residues
- Liability of Natural Products Refining Company (NPRC), PPG, and the United States Government (US), as arrangers of waste disposal, under the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- CERCLA liability of NPRC, PPG, and the US as operators of the Plant
- What he argues is an equitable allocation of response costs associated with the environmental harm caused by the chromium wastes generated at the Plant
- Citizen suit under the provisions of the Resource Conservation and Recovery Act (RCRA)

Many of the inaccuracies and fallacies offered by Mr. Zoch relate to the history of the relevant period and the Government's regulation of the economy as a whole and its interactions with NPRC and PPG in particular. These are addressed in the October 7, 2016, expert report of Dr. Jay L. Brigham and in his January 6, 2017 rebuttal report herein.

Other inaccuracies and fallacies offered by Mr. Zoch are based on the interpretation of aerial photographs by Mr. Randall Grip. These are addressed by Ms. Kristen K. Stout in her rebuttal report and in my rebuttal below regarding Mr. Zoch's proposed cleanup cost allocation.

To the extent discussed herein, I found many of Mr. Zoch's opinions to lack a scientific, logical, or factual basis for one or more of the following reasons:

- Reliance on statements or conclusions that are untrue, unsupported by the evidence that he cites, or that are contradicted by the available evidence
- Reliance on statements or conclusions that are conjecture, speculation, arbitrary, poorly reasoned, or the repackaged arguments of PPG attorneys
- Reliance on unjustified or unreasonable assumptions

- Reliance on selective, biased “cherry-picking” of evidence
- Reliance on flawed logic
- Constituting opinions of law as contained in PPG’s complaint, rather than of opinions in scientific, engineering or other independently applied areas of expertise

In the following sections of this report I point out the most significant problems I find in Mr. Zoch’s report within the scope of my issues in this case and the basis for my conclusions.

2.0 SUMMARY OF PROBLEMS WITH THE ZOCH OPINIONS AND BASES

I find three major topical areas of Mr. Zoch’s opinions, and all of them are substantially flawed:

2.1 Opinions and cited evidence regarding CERCLA liability of the United States as an alleged “operator” of the Plant

Mr. Zoch concludes that United States Government agencies exercised various kinds of control over Plant operations and waste disposal during World War I (WWI) and World War II (WWII). He claims that the US issued various directives and mandates to NPRC regarding Plant production processes, waste disposal, and labor management and thus bears CERCLA liability as a Plant operator. I have considerable experience in assessing the kinds of facts on which courts have based operator liability under CERCLA. In summary, the evidence cited and speculation that Mr. Zoch offers to support his opinions on this issue fail to show that the US ever issued directives, orders, or mandates to NPRC that amounted to control over any of the Plant processes or waste management and disposal. Likewise, the available evidence indicates that the US never stationed Government personnel at the Plant and never operated any equipment or processes at the Plant. Mr. Zoch’s references, legal argument, and speculative conclusions fail to show the kinds of facts on which CERCLA operator liability has been found. Specific problems with Mr. Zoch’s basis for his conclusions are described in more detail in Section 3.0 of this report, below.

2.2 Opinions and cited evidence regarding CERCLA liability of the United States as an alleged “arranger” of waste disposal at the Plant

Mr. Zoch claims that the US also bears CERCLA liability because it played a significant role in arranging for the disposal chromium-bearing mud residues from the leaching step of the chromite ore processing operations at the Plant. These “arranger” conclusions are flawed and lack a credible basis in the same ways as his “operator” opinions. None of the evidence cited by Mr. Zoch shows that the US ever owned or possessed any wastes at the Plant, issued any orders,

directions, mandates or instructions to NPRC regarding waste generation, waste management, or waste disposal, nor does the evidence indicate that the US ever exercised any direct or indirect control over any waste disposal activities or decisions at the Plant. Mr. Zoch's conclusions are again based on conjecture, speculation and assumption unsupported by hard facts. My specific rebuttal points on this topic are presented in Section 4.0 of this report, below.

2.3 Opinions and cited evidence regarding the response cost allocation scheme proposed and applied by Mr. Zoch

Mr. Zoch then offers a cost allocation scheme based on the defective opinions regarding alleged US liability as a Plant operator and waste disposal arranger at the Plant. His allocation opinion itself suffers from its own lack of evidentiary basis and failure to consider evidence that contradicts the elements of that scheme. The numerous defects and failures in his house-of-cards allocation scheme are described in Section 5.0 of this report, below.

3.0 OPINIONS REGARDING UNITED STATES CERCLA LIABILITY AS AN OPERATOR OF THE FORMER PPG CHROMATE CHEMICAL PLANT

3.1 Overview

One of the primary legal conclusions stated repeatedly by Mr. Zoch is his agreement with PPG's allegation that the US was a CERCLA "operator" of the NPRC and PPG Plant during WWI and WWII. He bases this conclusion primarily on the following points.

3.2 Government Stockpiling of Chromite Ore and Controls Over Ocean Shipping

Mr. Zoch claims that because of US concerns about foreign supplies of raw chromite ore becoming unavailable in the late 1930s and WWII years, the Government began buying up and stockpiling chromite ore from domestic and foreign suppliers, from the late 1930s through early 1941. [p. Sections 2.4.2, p. 15, and 2.4.3, p. 16, of his report]

These arguments are debunked by the voluminous and historically accurate relevant evidence cited by Dr. Brigham in his reports. Moreover, none of the documents cited by Mr. Zoch or that I have reviewed indicated that NRC ever lacked an on-site ore stock for maintaining continuous production during WWII. Mr. Zoch's statement and implications that the Government stockpiling program controlled NRC or prevented the company from having adequate access to ore to keep the Plant producing at full or near-full capacity are baseless. Mr. Zoch cites no evidence that the Government chromite ore stock piling program had any bearing on or control over NRC's production processes or waste management operations at the Plant. Furthermore, none of the evidence cited by Mr. Zoch or that I have been able to find indicates that the Government's ore stockpiling program had any discernable impact on NRC's production processes, products, waste management, or ability to conduct business as usual.

3.3 Other Alleged Government Controls

Mr. Zoch claims in Section 2.4.1 of his report that the US exercised control over NPRC during WWI. As evidence, he claims that NPRC expanded its chromate production in 1915 to meet war needs, and implying that it did so under some sort of Government directive, order or mandate. Mr. Zoch claims further in Section 2.4.1 that the US Government “...*quickly established new methods of government control over almost everything that was used and produced during World War I by the 28,000 manufacturing plants included in the government’s inventory.*” (implying that the Government took control over the NPRC Plant)..

Mr. Zoch claims that the Government began exercising WWII controls over the U.S. chromium industry beginning on July 7, 1941 by placing chromium under “full priority control.” [Section 2.4.3, p.17; Section 4.2.1] He refers to additional orders and directives as having been issued thereafter regarding allocation of raw ore sales from the Government stockpile to processors like NPRC, for setting price ceilings on chromite ore and on chromium chemical products, for setting allocations and restrictions on which primary chromium chemical users could buy and use primary chromate chemicals like those produced by NPRC. [Section 4.2]

Mr. Zoch also claims that the Government maintained control over the NPRC Plant by threatening to commandeer or seize control of the plant during WWI and WWII [Section 4.2.1, p. 37-38].

Mr. Zoch alleges or implies that the Government issued mandates, orders or directives that caused NPRC to change its plant operations or otherwise implement Government controls over NPRC’s Plant operations. [Section 4.2]

Mr. Zoch also claims that the Government somehow directed or otherwise caused NPRC to change its Plant processes in a way that caused additional chromium wastes (muds) to be generated. [Section 4.2.5]

Mr. Zoch also claims that the Government controlled NPRC’s labor force, in a way that somehow constituted operational control of the NPRC Plant. [Section 4.2.4]

Finally, Mr. Zoch claims that the Government exercised control over NPRC’s Plant and operations by pressuring NPRC to participate in a Government subsidy program that required NPRC to change the plant process and use more expensive high-grade metallurgical chromite ore or change its process to a more costly one-stage leaching process. [Section 4.1.3, p.33]

REBUTTAL

These arguments are refuted by the voluminous and historically accurate relevant evidence cited by Dr. Brigham in his reports. The documents cited by Mr. Zoch do not substantiate the PPG

“operator” allegations that he reiterates as to either World War I or World War II. Mr. Zoch cites nothing (1) showing any actual relevant Government directions, orders or mandates; (2) linking the NPRC Plant to his claim that the Government somehow exercised control over 28,000 industrial plants in the United States at some point during World War I; (3) showing that the regulatory controls exercised by the Government over the economy, including chromium chemicals, somehow amounted to the kind of day-to-day management and supervision of factory workers, equipment and wastes during either war; (4) establishing that the Government ever took over the NPRC plant because the company defied a Government order to produce or because a strike interrupted production there, or that the Government ever threatened to do so during either war; and (5) showing that the Government coerced or pressured NPRC to participate in a government subsidy program that required NPRC to change the plant process to a less efficient but more productive roast and leach regime (and/or use more expensive high-grade metallurgical chromite ore), or that NPRC ever in fact participated in such a program.

Neither is there any record of any Government or military personnel ever being at the NPRC plant for any operational, management or control purpose, or that any such federal personnel ever directed, managed or supervised NPRC employees.

Finally, Mr. Zoch cites no evidence that indicates that any Government personnel or agencies participated in or made decisions regarding how, when or where NPRC handled and disposed of its production process wastes, or that the Government had any duties or responsibilities in such matters. He also fails to produce any evidence that anyone other than NPRC ever had any control over NPRC’s wastes or the processes that produced those wastes.

3.4 Conclusions Regarding Alleged Government Responsibility as a CERCLA Operator

I have worked on dozens of CERCLA allocation cases where the relative responsibilities of possible facility operators had to be determined. In those cases and others I have reviewed, I have never encountered a case where a party was determined to have CERCLA operator responsibility if it was not clearly and directly involved in the day-to-day facility operations that caused the releases.

Based on my familiarity with CERCLA allocations and a practical understanding of facts significant to “operator” determinations by courts under CERCLA, Mr. Zoch’s conclusion that the government was an operator of the NPRC Plant and its processes, including waste management and disposal, fails for lack of a credible basis.

4.0 OPINIONS REGARDING UNITED STATES CERCLA LIABILITY AS AN “ARRANGER” FOR WASTE DISPOSAL AT THE FORMER PPG CHROMIUM CHEMICAL PLANT

4.1 Overview

Mr. Zoch also adopts PPG's allegation that the US bears CERCLA liability by arranging for the generation and disposal of chromium bearing wastes at the Plant during WWII. He unsuccessfully tries to support his allegation by making the following arguments.

To the extent that Mr. Zoch reuses here allegations from the "operator" portion of his report, I incorporate here my responses stated above. To the extent that Mr. Zoch raises other supposed evidence for his arranger argument, the Government's detailed responses are incorporated in Dr. Brigham's rebuttal report and in Ms. Kristen Stout's rebuttal report, and are summarized here.

Mr. Zoch states that due to the shortage of sodium bichromate during WWII, NPRC, as one of five primary chromate chemical producers in the U.S., was under "significant scrutiny" by the Government. [Section 4.1.1, p. 29]

Mr. Zoch points out that primary chromium chemicals (such as NPRC's sodium bichromate) were placed under allocations by the Government orders effective October 1, 1943, implying that the allocation program constituted Government controls of NPRC's production processes and waste management and disposal practices within the Plant itself. [Section 4.1.1 p. 30]

Mr. Zoch describes in Section 4.1.2 of his report investigations by the Government into ways that the chromate industry might be able to increase production rates to meet increasing demands during WWII. The Army Services Forces suggested that the Government's Metals Reserve Company (MRC) could implement a plan to sell high-grade chromite ore at a low price to primary chromate producers like NPRC, and take title to the sludge (mud) from a one-time-through processing -- sludge that would still contain recoverable chromium. The War Production Board suggested in 1944 that NPRC might increase production by eliminating ore reworking (reworking muds from once-through ore processing) with MRC purchasing the resulting sludge. Mr. Zoch implies that such suggestions or recommendations implicate the Government as involved with arranging for the disposal of NPRC's chromium wastes.

Mr. Zoch shows that the Government suggestions for increasing chromate production resulted in approval of a subsidy program for the primary chromate chemical producers by the Government's Defense Supply Corporation (DSC) in May 1944. Four of the five producers initially signed agreements to participate in the program, followed later by NPRC in June 1944 (implying that NPRC agreed to Government controls and payments for changing its operations). [Section 4.1.3, pp. 32-33]

In Sections 4.1.4 and 4.1.5 of his report, Mr. Zoch presents what he claims are lines of evidence and interpretations indicating that NPRC changed its chromite ore processing steps to comply with some sort of Government mandate or directive and that NPRC entered into an agreement with the Government to do so. He further alleges that this change resulted in the generation of

greater volumes of chromate-bearing waste muds (for which he alleges that the Government should be responsible, thus making the Government liable for arranging waste disposal).

REBUTTAL

Mr. Zoch implies that his vague phrase “significant scrutiny” by the Government somehow makes the Government responsible for NPRC’s management and disposal of its plant wastes that caused the releases. Whatever he means by “significant scrutiny,” he does not explain how the Government’s attention to and regulation of the chromium chemicals industry differed from any other US industry providing equipment or commodities used in the war efforts, or that the chromium chemicals industry was in any way unusual or unique in this regard. Nor does Mr. Zoch tell us how it was that the information the Government obtained through its regulation of this industry and this so-called “scrutiny” amounts to “control” of the day-to-day management by NPRC personnel of its workers, its production equipment and processes, and its waste disposal operations. To the contrary, the available evidence shows with certainty that the Government’s regulatory allocation of chromium ore among chemical products manufacturers, including NPRC, did not amount to control of such NPRC activities within the boundaries of the Plant. The same is equally true with respect to the Government’s regulatory allocation among the consumer industries of the primary chromium chemicals produced by companies like NPRC. None of the documents or other evidence cited by Mr. Zoch identifies any such equivalence or connection.

None of the documents cited by Mr. Zoch relating Government suggestions or recommendations offered to NPRC to improve the chemicals output from its production process indicates that NPRC was ever directed, ordered, mandated, or coerced to adopt or implement any of the Government suggestions, or even that NPRC ever actually did so at all.

As discussed earlier in this rebuttal report, although NPRC initially signed an agreement to participate in the high-grade ore subsidy program, later documents show that NPRC subsequently declined to participate and did not file for or receive any subsidy payments. Even if NPRC had participated in the subsidy program, its participation would have been voluntary, just as its decision not to participate was voluntary, and Mr. Zoch cites nothing that suggests the contrary. Although Mr. Zoch cites many documents that *talk about* the subsidy program, he omits key documents that clearly indicate that NPRC backed out of the program before beginning any ore processing under the program. For example, in a June 8, 1944 letter from NPRC to Defense Supplies Corp., NPRC stated that it had no high-grade ore on hand and “...does not anticipate the purchase of any unless we are compelled to do so on account of a shortage of low-grade ore.” [PPGNPR0010899].¹

¹ Although Mr. Zoch cites a document that indicates that NPRC ordered a shipment of ore from the Metal Reserve Corporation in March 1944, this was two months before NPRC signed an agreement that enabled it to participate in the high-grade ore subsidy program, it is not clear from the document what type of chromite ore NPRC ordered, and there is no evidence to indicate that it was directed or mandated to do so by the Government [COMP0001051-52].

REBUTTAL

Mr. Zoch's entire chain of arguments regarding alleged NPRC process modifications suffers from one weak link of speculation after another and an utter absence of evidence. First, he alleges that, "*...NPR was singled out as the one producer who agreed to increase sodium bichromate production through process modification to reduce or eliminate leached mud reworking in the roasting operation.*" This is wrong and therefore misleading. There is no evidence showing that NPRC ever agreed to do that or in fact did so with either high grade ore or chemical grade ore. In fact, it was the *other* four chromate companies that attempted to increase production under the subsidy program by modifying their processes. Of those other four, only Mutual was actually able to show any increase in production. After a few months, the Government deemed the program a failure and cancelled it.

On page 26 of his expert report, Mr. Zoch states:

"...during WWII, there is an indication that the NPR ore conversion efficiency may have dropped to as low as 60%." [from 75 to 81%]

He makes that statement to support a following speculative conclusion that NPRC changed its production process in WWII in a manner that created much more waste mud per ton of ore processed. The evidence he cites as the basis for this statement states nothing about NPRC changing its process. One idea suggested by Government was the possibility of considering a once-through leaching step for the roast (regardless of the type of ore), rather than running the mud through additional leach cycles after the first leach and recycling some of mud in the roast. In discussing that idea, mention was made that, if adopted, the change might result in a drop in conversion efficiency to 60 % from 85%. There is no evidence that NPRC ever adopted such a suggestion or was directed to do so by the Government.

Mr. Zoch goes on to restate as an established fact, rather than a mere possibility, his unfounded speculation regarding NPRC's alleged process change during WWII on page 27 of his report:

"Contaminated runoff released from mud piles...impacted surface water on and adjacent to the Site as well as groundwater beneath it, especially during the World War II time period when ore conversion efficiency was significantly reduced." (emphasis added)

Mr. Zoch has provided no factual evidence that NPRC's conversion efficiency was reduced in the WWII period. However, he does provide clear evidence that NPR knew in 1952 that its waste mud piles were leaching toxic Cr-6 to surface water and groundwater, which supports my related opinions offered in my October 7, 2016, expert report.

Mr. Zoch then offers the following speculative arguments: (1) NPRC's increase in the consumption of ore in 1944 must have been the result of its implementation of a one-time-

through ore roast and leach process, without recycling any of the mud (whether with normal chemical grade ore or high grade ore)²; (2) a string of mud carts that appear on a July 1944 aerial photograph of the Plant indicates that NPREC changed its process in this way; (3) the appearance of a pile of light-toned material in the same area as the carts on a 1947 aerial photograph indicates that NPREC must have begun using lime in connection with this modification of its production process; and (4) the assumed NPREC process modification must have been the result of “*some form of contract or agreement, possibly with the military (e.g., the Navy as part of the stockpile authorization of the Army Service Forces or the DSC, to subsidize process modifications of [NPREC’s] ore roasting operation.*” Mr. Zoch offers no reliable basis for any of this. Nonetheless, according to Mr. Zoch, this jumble of baseless assumptions and guesses “*is sufficient to demonstrate that the NPR process modifications proposed by the WPB did, in fact, occur through contract, agreement or otherwise, and that U.S. is therefore liable as a CERCLA arranger for Site contamination.*”

To the contrary, NPREC continued buying chemical grade ore from the MRC during 1944, and there is no reason to suppose that its increased 1944 consumption included anything other than this. Moreover, the presence of a string of mud carts in a July 1944 aerial photograph of the Plant and the appearance of a pile of light-toned material in a 1947 aerial photograph of the Plant proves nothing about whether NPREC did or did not implement a modification of its production process. Finally, Mr. Zoch assumes with no evidence that there must have been “*some form of contract or agreement, possibly with the military . . . to subsidize*” this process modification of NPREC’s ore roasting operation.

In addition as confirmed by Ms. Stout in her rebuttal report, I examined aerial photographs from April 6, 1940 [USNPR0013840]; November 1, 1940 [Randall Grip expert report, October 7, 2016]; December 24, 1943 [USNPR0013841]; July 1, 1944 [Grip expert report, October 7, 2016]; December 1944 [USNPR0013842]; and April 28, 1947 [USNPR0013843]. Each of these photographs shows the presence of the light-toned pile of material near the south end of the production building. If that material is evidence of a process change, as Mr. Zoch claims, then the change must have occurred before April 1940 (before the US was involved in WWII). In addition, all of these photographs after 1940 show the presence of mud carts near the light-toned material near the south end of the production building. Yet Mr. Zoch claims that the presence of mud carts near the light-tone pile in 1944 is evidence of a process change in 1944. If the presence of mud carts near the light-toned pile is evidence of a process change, then the change occurred before December 1943.

² Mr. Zoch states (pp.31-32) that this one-time-through leaching technique is “*...sometimes referred to as a “cream skimming”, and a procedure utilized at other primary metals processing facilities during World War II to increase production.*” However, he provides no evidence or citation to support such a statement. Mr. Zoch uses the term “cream skimming” again on pages 34 and 35 of his report. Yet “cream skimming” is not a technical term that I have seen used in metallurgical/chemical engineering processing literature, nor is it a term used in the government documents that Mr. Zoch cites. Finally, there is no evidence that the government directed or ordered NPREC to implement such a process change or that the Government ever paid a subsidy to NPREC to implement such a change, or that NPREC actually did implement such a change.

If NPRC made a process modification after late 1945 (which could explain Mr. Zoch's interpretation of the April 1947 photograph), it was after WWII and after any alleged wartime government involvement. Furthermore, there is no evidence presented regarding why such a change was made, if, in fact, it was made. Mr. Zoch again fails to provide any documentary evidence that NPRC was ever directed by the government to change its process or that it entered into any kind of agreement with the government to do so.

Mr. Zoch therefore not only improperly offers a legal opinion regarding CERCLA "arranger" liability, but his proffered factual bases for that opinion fall apart on examination of them and the undisputed record as a whole. His "arranger" conclusion has no scientific or other basis and flies in the face of extensive other credible evidence to the contrary, as discussed above.

In my work on many other CERCLA allocations involving WWI and WWII industrial facilities, I have never come across a case where the Government was assigned arranger liability at a plant like the former PPG Plant under circumstances such as these.

5.0 OPINIONS REGARDING EQUITABLE ALLOCATION OF RESPONSE COSTS

5.1 Overview

In Section 5 of his report, Mr. Zoch offers what he proposes is an equitable way of allocating response costs for the environmental harm caused by the chromium wastes from the Plant. His allocation scheme rests not only on the unjustified liability opinions he offers, but on his entirely separate set of flawed and inappropriate factors. The conclusions that PPG has failed to carry its burden of proof and that the Government has not been shown to be liable under either of Mr. Zoch's theories renders his equitable allocation moot.

Moreover, if Mr. Zoch's allocation proposal needs to be considered by the Court at all, his entire scheme offered at PPG's behest is invalid for the following series of reasons.

The factors used by Mr. Zoch as the basis for his allocation scheme are

- Relative time of use
- Relative production rates
- Waste volumes generated during PPG's ownership and operation
- Relative degree of involvement/responsibility exercised by the two entities at the Plant

He incorrectly assumed that the entire period of plant operations ran from 1910 through 1963 (642 months) rather than June 1909 through June 1963 (648 months). He also assumed that the periods of Plant operations during the wartime portions of this period were approximately 8 months for WWI and 60 months for WWII.

The way he computes his "normalized" time-of-use factor is seriously flawed. I also disagree with Mr. Zoch's implicit assumption that the US had any responsibilities for the Plant production

or waste disposal activities at any time during either war period, let alone for the entire duration of each period, as Mr. Zoch assumes. I therefore find his conclusions regarding relative degree of involvement to be arbitrary, baseless, and counter to available evidence and to common sense.

Mr. Zoch selected Plant production rates as one of his allocation weighting factors (pp. 43-45 of his report). He then provides estimates of production rates for the 1910-1932 period, without providing any factual basis or citations for the estimates. For example, he assumes that the unknown production rate from 1910 to 1932 was half of his assumed rate after 1932. His post-1932 assumed production rates are based on the capacity of each roasting kiln (apparently assuming that they all were operated at maximum capacity, which is unlikely), without citing any factual production rate data. Finally, he applies his assumed production rates as a weighting factor to his time-of-use factor to compute his final allocation percentages. Due to the uncertainties in his speculative production rates, the resulting weighted time-of-use factors and final allocation percentages have comparably high degrees of uncertainty and unreliability which he fails to acknowledge, (in addition to the other flaws and problems I point out with his allocation scheme and the manner in which he applies it).

5.1.2 Problems with Incorrect Time-of-Use Normalization Calculation

In Section 5.2 of his report, Mr. Zoch tabulates his time-of-use factor for his allocation. His terminology indicates that he assumes that the Government “used” the Plant for the entire period that he assigned for each war, even though he has provided no evidence that indicates that the US ever did so.

Assuming that the US would share liability with the Plant owner and operator, NPRC, Mr. Zoch apportions the time-of-use factor during the two war periods between them. However, he applies a flawed normalization calculation that results in an erroneous factor nearly twice as large as it should be for the US. That step is reflected in Mr. Zoch’s Table 4 (p. 44 of his report). Without accepting that any allocation to the US is warranted, I describe these flaws in his calculation as follows:

- He assumes that the Plant began operations in 1910, when, in fact, it apparently began operations in June of 1909 [PPGNPR0089439-49 at 47]. That adds six more months to the period of time that NPRC bears sole responsibility for Plant ownership and operations for the non-wartime periods from June 1909-June 1954: (540-68 = 472 months³). That is 72.8 percent of the total operational time of the Plant (648 months). NPRC’s correct time-of-use factor for that period should therefore be 72.8 percent, plus a portion of the 68-month wartime periods.

³ 540 months is the total time of NPRC Plant ownership and operation, from 1909 to 1954. 68 months is the total wartime operational period, WWI plus WWII.

- Similarly, PPG was the sole owner and operator of the Plant from July 1954 to June 1963 (108 months) and should be assigned 16.67 percent for its correct time-of-use factor ($108/648 = 16.67$ percent).
- If the wartime periods totaling 68 months are shared equally between NPRC and the US (for time-of-use factor only), then each would be assigned 5.25 percent for that factor ($68/648 = 10.5$ percent). That factor should then be weighted heavily toward NPRC as the actual owner/operator of the Plant. Mr. Zoch fails to do this.
- Using these values, the correct time-of-use factor for NPRC should be at least $72.8 + 5.25 = 78.05$ percent, without applying a weighting factor to the wartime years. In contrast, Mr. Zoch's flawed normalization method gives NPRC 75.2 percent.
- My corrected time-of-use factor for PPG is 16.67 percent, contrasted with Mr. Zoch's flawed factor of 15.2 percent derived from his misapplied normalization adjustment.
- My corrected US time-of-use factor for the US is 5.25 percent (without applying a justifiable weighting factor that would decrease the US percentage), compared to Mr. Zoch's incorrect factor of 9.6 percent, resulting from his misapplied normalization adjustment.

The above-cited errors in Mr. Zoch's Table 4 time-of-use factors all carry over into his Table 5 numbers regarding his production weighted time-of-use factors. Therefore those values are similarly incorrect by assigning factors to the US that are nearly twice as high as can be justified even under by Mr. Zoch's scheme.

These erroneously high factors for the US are, in turn, carried into Mr. Zoch's Table 6 where he computes his final allocation percentages for each of the parties, rendering those allocations also invalid for that reason alone. However, Mr. Zoch's allocations in his Table 6 are further invalidated by his unfounded assumptions regarding his "degree of involvement" factors that he assigns to the US versus NPRC for the wartime periods. That problem is explained below.

5.1.3 Problems with Zoch's Arbitrary and Unjustified Degree of Involvement Assumptions

In Section 5.4 of his report, Mr. Zoch applies his third factor, degree of involvement, to compute his final allocations. He correctly assigns 100 percent to NPRC and to PPG for their respective non-wartime periods of ownership and operation. However, he unjustifiably and with no explanation assigns 40 percent responsibility to the US for the WWI period and an even more incredible 75 percent to the US for the WWII period.

Mr. Zoch's degree-of-involvement factors for the wartime periods are not based on any known facts or evidence relating to either period, and are therefore unjustified. The most serious problem in this step of his allocation is his erroneous and baseless assumption that the US should bear 100 percent of the operator responsibility (an arbitrary 40 percent of total responsibility) for the WWI period (8 months) and 100 percent of both operator and arranger responsibility (an

arbitrary 75 percent of total responsibility) for the WWII period (60 months). As pointed out above, this is clearly contrary to available evidence and fundamental allocation principles. NPRC was not only the Plant owner during those years, it was obviously the only on-site operator and arranger.

My opinion, as an experienced expert in many CERCLA allocations, is, as even Mr. Zoch acknowledges, that such allocations are fact-intensive inquiries rooted in the particular facts of each case. His generalizations about allocations among owners, operators, and arrangers in other cases are useless here, unless the facts of allegedly comparable cases are examined along with the facts of this case, a matter for the attorneys, not Mr. Zoch. Moreover, his assignments of shares to the US have no basis in fact, are arbitrary, and are transparently and grossly biased in favor of his employer.

5.1.4 Analysis of Zoch's Chromium Residue Volume Data

Mr. Zoch relies on Operating Data Reports for the plant available beginning in 1958 to estimate the volume of waste mud that was either dumped or sold. [Expert Report of Robert M. Zoch Jr., P.E., October 7, 2016, p. 24] His total for the 1958 through June 1963 is 86,815 tons. [Id.] at 25. This consists of 56,932 tons sold and 29,883 tons dumped. A footnote to Zoch's Table 1 states that it is likely that much of the "dumped" mud was also used for off-site fill. [Id.]

Mr. Zoch apparently failed to consider information from a 1984 site evaluation commissioned by PPG and performed by a former chemist employed at the plant from 1957 through 1961.⁴ This PPG report estimated the volume of waste mud that was either dumped or sold over a much longer period of time – 1954 through 1963. Not only did the PPG report consider four additional years of mud produced at the plant, but it also estimated the surplus mud that PPG obtained from the prior owner after PPG acquired the plant.⁵ Id. at PPGNPR0557625-626. That report states:

"During the entire period when PPG operated the Jersey City chrome plant from 1954 to 1963 about 130,000 cubic yards (58,000 + 54,000 + 18,000) or 138,000 tons of surplus mud was disposed of. A small amount was given away. The rest was sold at prices ranging from 10 cents per cubic yard to 50 cents per cubic yard." [emphasis in original] PPGNPR0557626

By failing to use the information available from PPG's 1984 evaluation about the total volume of mud sold or given away between 1954 and 1963, Mr. Zoch misses at least 4 years of waste sales/giveaways (i.e., 1954-1957). When the 1984 PPG report analysis is considered, Mr. Zoch understates the waste volume associated with PPG's ownership and operation of the Garfield Avenue plant by more than 37 percent.

Although Mr. Zoch does not use this waste volume data directly as a factor in his allocation computations, by use of erroneously low volumes for the PPG period (1954-1963), he presents a false impression that PPG contributed relatively less to the environmental harm than it actually

⁴ Chromium Contamination Evaluation from Chester J. Milczarek (Consultant) to Susan G. Kuis (PPG Industries, Inc.), June 22, 1984, PPGNPR055761

⁵ Ibid., PPGNPR0557613 at PPGNPR0557625-626.

did. He also concludes without credible basis that the Plant produced more mud residue per ton during a portion of WWII because of NPRC's alleged process modification. That unfounded conjecture creates another false impression that more mud residue (which he also alleges contained higher concentrations of chromate) was generated per ton of ore processed during WWII.

5.1.5 Mr. Zoch's Designation of NRC's Allocation as an Orphan Share to Be Re-Allocated Between PPG and the US

In Section 5.5 of his report, Mr. Zoch concludes that his computed allocation for NRC should be treated as an orphan share and divided proportionately between his remaining viable parties, PPG and the US, according to their relative allocation percentages. Treatment of the NRC share is dependent on a legal theory and interpretation for which Mr. Zoch does not present himself as qualified to offer. Neither am I qualified to render a legal opinion on this matter. Therefore, until any such legal determination is made, the normal conservative approach in allocations would be to at least acknowledge that when a prior responsible party like NRC is absorbed by a successor company like PPG, the Court must determine whether or not the successor company should be assigned the environmental responsibilities of the predecessor company.

Mr. Zoch fails to even acknowledge any such possibility. He merely assumes that NRC is an orphan in order to deflate his allocation in favor of PPG and inflate it against the US. If the NRC share were reassigned to PPG, as the US contends, the resulting allocation to the US would be only 7.7 percent under Mr. Zoch's scheme; however, his treating NRC as an orphan almost triples this to an allocation to the US of 22.3 percent.

5.2 Conclusion Regarding the Zoch Allocation Scheme

The rebuttal points presented above show that Mr. Zoch's proposed allocation scheme is based on grossly flawed assumptions and errors, is contrary to settled principles used in equitable allocations of cleanup costs, and must be rejected. Mr. Zoch's allocation scheme appears to be intentionally designed to bias the outcome unjustifiably against the US and in favor of PPG, as indicated by the following summary of key flaws in his scheme:

- Unjustified baseless conclusion that the US was a CERCLA "operator" of the Plant during WWI and WWII
- Unjustified baseless conclusion that the US was a CERCLA "arranger" of waste disposal during WWII
- Use of erroneously low total Plant time of operation
- Use of erroneous "normalization" adjustment for relative time-of-use factors
- Unjustified assumptions regarding production rates from 1909 to 1954

- Unjustified low allocation to NPRC and PPG for CERCLA “owner” share of liability
- Unjustified and unrealistically high “degree-of-involvement” factor for the Government during WWI and WWII
- Erroneously low estimate of waste volumes acquired and generated by PPG 1954-1963
- Unjustified legal conclusion that NPRC’s allocation should be treated as an orphan share

Each of these major flaws in Mr. Zoch’s allocation scheme resulted in increasing the allocation percentage that he claims is equitable for the United States, and shows bias rather than independence as an expert.